SEP 7 1920

SERIES 3—Vol. 3, No. 9 SEPTEMBER, 1920

AMERICAN JOURNAL OF OPHTHALMOLOGY

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Annual Subscription Ten Dollars in Advance,
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PUBLISHED MONTHLY BY THE OPHTHALMIC PUBLISHING COMPANY,
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Entered as Second Class Matter January 1st, 1918, at the Post Office, Chicago, Ill., under the act of March 3rd, 1879.

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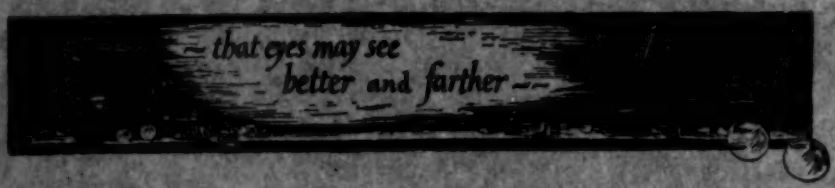

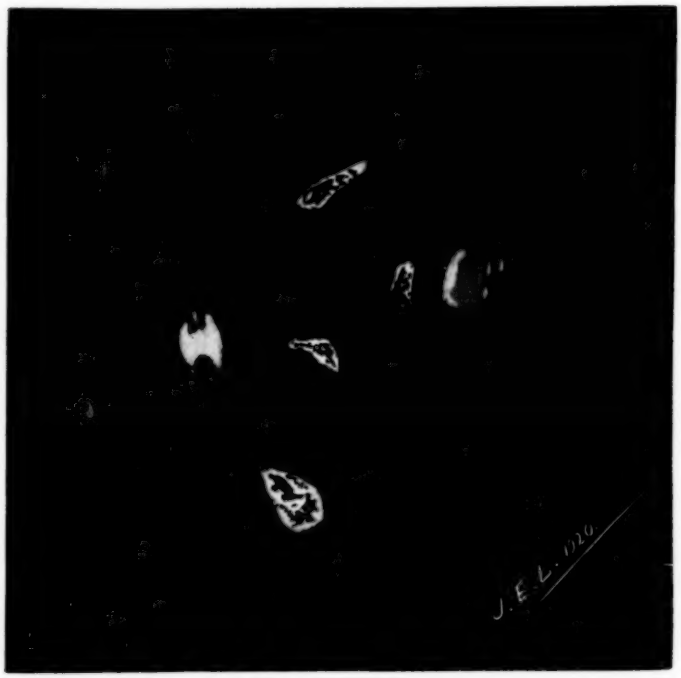

MULTIPLE ANEURYSMS OF THE RETINAL ARTERIES. FERNANDEZ.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Vol. 3 SEPTEMBER, 1920 No. 9

MULTIPLE ANEURISMS OF THE RETINAL ARTERIES.

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The character and early termination of the case here reported suggest the discussion of the prognostic significance of such lesions and their relation to arteriosclerosis.

Aneurisms of the retinal arteries, without being exceedingly rare are infrequent enough to justify describing a case when seen. In this case the most striking points were the shortness of the process and the fatal termination.

Without doubt in the etiology of these vascular lesions of the retina, arteriosclerosis plays an important part. Arteriosclerosis may affect the fundus in different ways, and in the retina it is characterized according to Roemer,[1] by the engorgement and tortuosity of the arteries at first, and later, by the thickening of their walls with attending reduction in their caliber, and consecutive endarteritis.

De Schweinitz[2] has shown the rarity of aneurismal cases, and believes that when they exist, they denote the coexistence of arteriosclerosis in other organs, especially in the brain. This emphasizes the serious way we considered our case, and this unfortunately was justified in a few weeks.

Sometimes arteriovenous aneurisms have been observed, which Fuchs has thought to be due to trauma. Von Hippel has seen some cases of the arteriovenous form which he believed might be due to tuberculosis, and Foster[3] has called attention to the existence of some deposits of cholesterin along the vessels, which are, he believes, appropriate places for the formation of thrombi. Leber[4] has described a form of miliary aneurisms, in cases of retinitis, that consist in an extensive infiltration of the retina, and also with a group of multiple aneurisms. Knapp has remarked many of these cases have occurred in young people, in some of which one has to believe in a tubercular origin.

The authors mentioned, as well as Axenfield[5] and Greeff[6] believe the etiology to be arteriosclerosis in almost all the cases, and it must be so, because ocular arteriosclerosis is so frequent that in Posey and Spiller's work,[7] the opinion of some authors has been quoted who believe that over fifty per cent of general arteriorsclerosis has some kind of ocular localization.

The seriousness of the cases of aneurisms with hemorrhages has been remarked by Duane,[8] in his splendid translation of Fuchs' work. He believes that in some cases they are "advanced signals" of cerebral hemorrhages. This is just the case in the subject of our observation.

It seems proper to review some of the most recently published cases, in which the prognosis for life has not been serious. Pringle[9] describes the case of a young English soldier, 23 years old, without any ocular traumatisms, who for the past 18 months complained of seeing cloudy with both eyes; and in whom the author found arterial aneurisms of both fundi. Jennings[10] has also seen a case in a young man, 21 years old, with aneurisms in one eye, and Komoto[11] describes a case of a boy, 16 years old, who had been sick for three years, in whom he found besides aneurisms, some white zones in the neighborhood of the macula. In Jennings' case there were hemorrhagic zones, but not so in the other two cases.

It is without any doubt that these three cases have not the serious character that marked our case, chiefly on account of the age of the patients. But it is worth while to notice that Jennings saw his case again after three months, and found that some of the aneurisms had increased in size. This fact, together with the circumstance that there had occurred some previous retinal hemorrhages, does not impress one very favorably from the standpoint of the prognosis, and especially locally, because it is more than probable that the hemorrhagic processes will be repeated; and that they may, after some time, give rise to some glaucomatous condition, which in turn may require enucleation.

The prognosis then of these affections should not be serious concerning the life of the patient, when the subjects are young people, among whom general arteriosclerosis can not be expected to be so frequent as in old age. Concerning those cases in people over 40, altho Adams[12] has stated that with advanced age, the probabilities of life are better, this opinion could be applied to the whole group of vascular retinal troubles, but not especially to the hemorrhages due to ruptures of aneurisms that, from a logical point of view, should tend to increase in size.

Intraocular tension, or better still, intraocular arterial tension in its relation to general blood pressure, altho it might clear away some of the doubts, and even be of some use for the prognosis, can not be depended on entirely, because as Foster Moore[13] has found, at times the pressure of the brachial artery is about 250 mm. of mercury and yet is below normal in the retinal vessels. On the whole, however, as Bailliart[14] has been able to prove, there is a constant relation between both pressures.

CASE. Mr. R. B. C., 54 years old, consulted us on November 4, 1919, stating that for the past six weeks he had suffered a marked diminution in the vision of his left eye. This symptom had increased very much lately. The general appearance of the patient was that of a man much older, and one could see very plainly the extreme tortuosity of the vessels along the temples, denoting an advanced state of arteriosclerosis.

There was nothing abnormal about his clinical history; the patient had not been a syphilitic nor a drinker; his habits were moderate and altho he smoked some cigars a day, his ocular lesions were found to be quite different from those described in tobacco amblyopia by our teacher Santos Fernandez.[15]

Vision in the left eye was limited to distinguishing fingers at two meters. In the right eye, vision was 2/3, but after correcting his hyperopia, reached to normal.

The ophthalmoscopic examination, with the May electric ophthalmoscope, showed a very curious and remarkable condition in the left fundus. One could see in the arterial vessels of the retina many aneurisms, more abundant in the upper branches. Near some of them, there were seen in the retina hemorrhagic zones of recent appearance, and in at least two different regions of the retinal field small atrophic zones, of different phases, but making it clear that the clinical findings were only different phases of the same process. In that way, the atrophic zones were the oldest lesions, and were due to the previous hemorrhages that had been absorbed. The new hemorrhages were the product of the ruptures of some of the aneurisms, that must have resembled before that stage, a chain or "rosary," of small links.

Arterial tension in this case was high, reaching 180 mm. Hg. Believing the case to be in a critical condition, we gave our opinion to his attending physician, who accompanied the patient to our office. We agreed to give him large doses of potassium iodid, besides other things indicated for his general arteriosclerosis, which we thought from the very first to be the most serious symptom. The patient went back to his home city, where he died from cerebral hemorrhage, on the 12th of December, 1919, forty days after consultation.

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RADIUM FOR CATARACT.

WALTER S. FRANKLIN, M.D., F.A.C.S., and FREDERICK C. CORDES, A.B., M.D.

SAN FRANCISCO

The influence of radium on lens opacities as studied in the Department of Ophthalmology in the University of California is reported in this paper, with an account of work previously reported in this direction by other observers. The results obtained are stated in tabular form. The paper was read before the California State Medical Society and is published here thru the courtesy of the Society and its Journal.

Various procedures have been attempted and a great deal of time and effort expended in an attempt to either absorb or check the progress of lenticular opacities. Numerous chemical reagents have been experimented with, but the results were discouraging and the treatment too severe and painful without sufficient improvement to warrant their continuance.

Cohen and Levin, of New York, in the early part of 1918 applied radium therapy systematically to cataracts. They reported an improvement in 87% of their cases. Following their presessional report, in April, 1919, we began radium therapy especially in cataracts, and this brochure expresses our tabulated results.

For ophthalmologists who possibly are not fully informed as to the known physics and therapeutic properties of radium, a brief resume will be given.

Radium emits "alpha," "beta" and "gamma" rays. Each type shows a relatively wide variability in velocity. The alpha and beta rays are particles of matter, while the gamma are similar to light waves, and those possessing shorter wave lengths are more penetrating than those possessing longer ones. In X-ray terminology the rays of shorter wave length would be classed as hard and the longer ones as soft.

The gamma rays are the more penetrating and concern us in therapy, while the alpha and beta should be excluded, altho it is probable that all three have a therapeutic effect, which consists in tissue destruction. The alpha rays are atoms of helium and are arrested by a small amount of screening, for example, the varnish of the glazed plaque practically rules all of them out. The beta rays are negatively charged electrons and, as they have an irritating effect upon the superficial structures, are excluded thru the proper screening. The gamma rays are similar to light waves.

The selective action of radium depends upon the fact that pathologic structures are more susceptible to reaction than are the normal tissues. For this reason, in treating a lesion that lies below the surface, it is neces-

sary to eliminate the elements which would affect the superficial layers without reaching the pathologic condition. This is the more imperative as the number of the penetrating gamma rays is much smaller than the number of beta rays. Due to diffusion the intensity of radiation varies, roughly speaking, as the square of the distance; thus by increasing the distance between an applicator and the lesion a more uniform radiation is obtained into the deeper lesion, A silver screen 0.5 mm. thick screens out all but 2% of the most penetrating beta rays and leaves practically all the gamma radiation. One mm. of lead screens out all of the beta as well as a part of the less penetrating gamma rays.

Radium has been used in ophthalmology for a number of years. At first it was applied to tumors of the lids and orbit. Somewhat later it was used in trachoma, then vernal catarrh, corneal ulcers, corneal scars, affections of the lids and other pathologic conditions. As a whole, the reports were encouraging altho some few men were skeptical as to its therapeutic value. The methods were for the most part crude; no special precautions were taken to screen the harmful rays. No definite system of dosage was used.

Lawson and Davidson[1] in 1910 used radium on a variety of cases. In their report their method is carefully described. The eye was cocainized and the radium which was contained in sealed glass tubes, permitting only the passage of beta and gamma rays, was applied directly to the affected part. The fingers of the operator were protected by enveloping first that part of the tube not required, then the fingers in a thick continuous wrapping of lead foil. The process was tedious. They used 20 milligrams of the element, with exposures from five minutes to half an hour. The frequency of exposure was governed by the progress of the condition. They reported on approximately 80 cases and noted no ill effects from the use of radium.

Koster[2] used a glass tube filled with radium which he placed, unprotected in any way, directly to the bulbar conjunctiva. The same amount placed in the skin would have caused a skin reaction, yet he noted no scleral burns. He used 2 milligrams of radium in his work and treated a variety of cases. His report on cataracts was negative altho he stated that in the star form in the anterior cortex, the opacities disappeared after five, one hour a week, sittings.

Cohen and Levin[3] in 1919 described their technic as follows: The radium was covered with brass, photographic paper and gauze and placed over the lid. The distance between the radium substance and the eyelid was about 2 cm. They used 2—3 mm. of brass screening and 2 cm. of gauze. The exposures lasted from one to two hours and were repeated twice a week during the first five weeks and then once a week.

The purpose of this paper is to describe the technic and give our results in thirty-one cases. Our method of application differs from the published description and has been the result of gradual development and the dosage somewhat arbitrary.

In the use of screens and distance, we have been guided by the experiences of the Department of Dermatology of the University of California.[4]

We are using 9.95 mg. of radium element in the form of radium barium sulphat in a circular gold plated glazed plaque over an area of 50.26 sq. mm. The apparatus consists of a specially designed silver cup to facilitate handling the radium. The bottom of this cup is made of a piece of silver 0.5 mm. in thickness and screens out practically all but the gamma rays. The cup is embedded in a block of vulcanite, the bottom of which is 0.6 cm. from the silver cup. The vulcanite is used as an easy method of obtaining a certain fixed distance and thus has the advantage over gauze pads. The container is now applied on a lead plate 1 mm. in thickness. This plate is shaped to cover the eyebrows and lashes and extends over the cheek a short distance. Directly under the radium is a hole 8 mm. in diameter (the diameter of the radium plaque). The lead plate

acts as an additional safeguard against alopecia of the eyebrows and lashes and gives a convenient method of applying the radium. There is some doubt as to the harm done by secondary rays, which in this apparatus would be given off by the lead plate, and to prevent the possibility of injury from these rays, a piece of rubber dam is placed, as an additional safeguard, below the lead plate.

The patient is placed in the prone position and the lids of the eye under treatment held closed by applying a small strip of surgeons' isinglass plaster. A small gauze sponge is placed on the eye to prevent the apparatus from coming in direct contact with the patient. Over this gauze sponge the radium apparatus is placed and held in position by two tapes and two small pieces of adhesive plaster. The patient is told to fix the ceiling with the uncovered eye, thus bringing the lens of the eye under treatment more directly under the radium. In this method, the radium is about 1.2 cm. from the eye.

The matter of dosage is rather an uncertain one, varying with each type of radium applicator. A milligram hour is the exposure to one milligram of radium for one hour. The term gives a method of dosage for a given plaque of radium if the conditions of screening and distance are included. In most of our cases, we have been giving 10 milligram hours twice a week for four weeks and then once weekly until the process is stationary. Following this, one exposure is given monthly. Experimentally it has been shown that the normal tissues of the eye are more resistant to the radium than the tissues of the skin, therefore, the lid gives a valuable indication against an overdosage, as a reaction would take place here before any injury could be done to the structures of the globe. In one of the earlier cases there was a mild reaction when less screening was used. The erythema of the lid passed away within a few days. No other reactions have been observed.

A radium emanation plant has been installed at the University Hospital and we are now using radium emanations in the treatment of a series of cases. The tubes are screened with silver so that the silver cup is omitted in the application; with this exception the method remains the same. The length of exposure varies according to the strength of the tube. The dosage given is equivalent to 10 milligram hours. For example, if a tube checks up as equivalent to 20 milligram gamma radiation, the time of exposure would be for half an hour. It is too early as yet to give the results with this method.

Before starting the radium therapy, the vision and ophthalmoscopic findings were carefully noted. Every month an examination was again made and the above recorded. When the vision remained stationary for one month, an application of 10 milligram hours every four weeks was found to hold the improvement. The chart shows graphically the results obtained while but a few of the cases will be described in detail.

CASE NO. I.

F. S., Female, age 58.

Complains that distance vision has gradually been failing. Change of glasses no help. External strabismus L. since fire, 1906. R. V. 0.2, L. V. 0.1 blurred. *Examination:* Incipient cataracts in both eyes. Fundi negative. Patient was given 190 milligram hours of radium at weekly intervals for a period of 6 months. At the end of that time vision was R. V. 0.6 vision. Vision has gone from 0.2 to 0.6.

CASE NO. II.

N. L., Female, age 32.

Examination showed perinuclear cataracts in both eyes. Fundi negative. R. V. 0.5; L. V. 0.5. Patient was given 60 milligram hours to each eye from Feb. 18, 1920 to March 25, 1920. At the end of that time R. V. was 0.8; L. V. 1.0. Vision has gone from 0:5 to 0.8 in R. and from 0.5 to 1.0 in L.

CASE NO. III.

A. S., Male, age 58.

Gradual failing of vision in both eyes, most marked in R., for last two

years. Examination showed an immature cataract in R. and an incipient cataract of the cortical type in the left eye. Fundus negative.

The patient was given 200 milligram hours of radium to left eye at weekly intervals over a period of 6 months beginning August 8, 1919.

Aug. 8. 1919, L. V. 0.5.

Oct. 19, 1919, L. V. 1.0.

Dec. 11, 1919, L. V. 1.2—4.

Reported back April, 1920, R. V. 1.2—3.

During this time R. V. became worse, going from 0.1 to fingers at 4 feet. No radium had been applied to right eye.

The vision of the left eye improved from 0.5 to 1.2—3.

CASE NO. IV.

N. H., Female, age 50.

Early incipient cataracts of nuclear type discovered during routine examination. Fundi negative. R. V. w. gl. 1.0; L. V. w. gl. 1.0.

Patient was given 50 milligram hours to R. and 90 milligram hours to L. From July 12, 1919, to Nov. 26, 1919, R. V. 1.2 at that time, L. V. 1.2. This case shows that very early cataracts will disappear entirely. To date (5 months later) there is no evidence of recurrence.

CASE NO. V.

M. P., Female, age 64.

Gradual failing of vision for past two years. Glasses no help. Examination: R. incipient cataract of the cortical type. Fundus negative. L. immature cataract.

R. V. w. gl. 0.5. Patient was given 65 milligram hours from July 12, 1919, to Nov. 13, 1919. R. V. at that time 0.8, showing an increase of 0.3. The opacities have thinned out a good deal.

Of the thirty-one patients under observation, 84.3% showed a change for the better, ranging from an improvement of 3—4 letters on the test chart to a complete disappearance of the process. In the cases that showed a marked improvement, the opacities were very definitely thinned out; one of these, a very early nuclear cataract, disappeared entirely leaving no trace of the opacities. In no instance where there has been an improvement has there been any retrogression to date, however, the time of observation has been too short to determine whether or not the cataract will eventually go on to maturity.

Twenty-one of the cases treated were private, the remaining ten being clinic patients. The percentage of improvements was much higher in the private cases. This is explained by the fact that due to the difficulty of obtaining the radium for the Out-Patient Department, these individuals did not receive the exposures systematically in many instances. This emphasizes the necessity of frequent systematic treatments in the beginning.

Radium is of proven value in the treatment of incipient cataracts. Our findings correspond sufficiently well with those of Levin and Cohen to indicate that it is not merely a coincidence but that actual results are obtained. Altho the vision cannot be brought up to normal in many individuals, the ultimate outcome is superior to an aphakic eye such as is obtained by surgery and does not subject the patient to the surgical risk of such a procedure.

CONCLUSIONS.

1. The application of radium does no injury to the normal structures of the eye.
2. It apparently has a selective action upon the lens.
3. Radium improved the vision in 84.3% of our cases.
4. A consistent technic and known dosage seems advisable.
5. Frequent treatments are necessary in the beginning.

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TABLE OF CASES

Class	NAME	Age	Amt. Radium Mil-hrs.	Dates		Vision Before	Vision After	Remarks
P.	Mrs. L. L.	58	R. 80	11-6-19	4-5-20	.3	.6	Improved
			L. 40	1-4-19	4-5-20	.5	.8	
P.	Mrs. A. B.	50	R. 50	3-1-20	4-12-20	wgl .1 chart	wgl .1	
			L. 50	3-1-20	4-12-20	wgl .4	wgl .6	Improved
P.	Mr. J. B.	66	R. 90	1-15-20	4-1-20	.3	.5	Improved
P.	A. H. B.	74	L. 80	3-10-20	4-8-20	.2	.4	Improved
P.	Mrs. M. G.	80	R. 80	2-11-20	4-7-20	.1	.2	Improved
P.	Mrs. F. D.	56	R. 70	7-17-19	12-18-19	.3	.6	Improved
			L. 80	7-17-19	12-18-19	.4	.6	
P.	Mrs. B.	50	L. 50	11-7-19	12-11	.8	1.1?	Improved
P.	Miss M. B.	81	R. 40	7-10-19	9-18-19	fingers at 10 ft.	.2?	Improved
P.	Mrs. A. L.	53	R. 100	7-24-19	1-22-19	1.0?	1.1	Improved
			L. 100	7-24-19	1-22-20	1.0?	1.1	
P.	Mrs. N. H.	50	R. 50	7-12-19	11-26-19	1.0	1.1	Improved
			L. 90	7-12-19	11-26-19	1.0	1.1	
P.	Dr., M. G.	53	R. 90	8-1-19	3-3-20	.5	.5	Not Improved
			L. 90	8-1-19	3-3-20	.5	.5	
P.	Mrs. D.	60	R. 40	1-14-20	3-11-20	.4	.5	Improved
			L. 40	1-14-20	3-11-20	.4	.5	
P.	Mrs. M. P.	64	R. 65	7-12	11-13	wgl .5	wgl .8	Improved
P.	Mrs. N. L.	32	R. 60	2-18-20	3-25-20	wgl .5	wgl .8	Improved
			L. 60	2-18-20	3-25-20	wgl .5	wgl 1.0?	
P.	J. P. L.	53	L. 80	1-30-20	3-18	wgl 1. ?	wgl 1.	Slight Improvement
P.	Mrs. B. V.	87	R. 20	10-9-19	10-30-19	02	Same	No Improvement
			L. 20	10-9-19	10-30-19	fingers 6 ft.		
P.	Mrs. F. T.	70	L. 80	7-11-19	3-24-20	wgl .1?	wgl .2-1	Improved
P.	Mr. P. A.	63	R. 120	2-2-20	4-13-20	.1?	.2?	Improved
P.	Mr. G. K.	60	R. 50	2-18-20	3-27-20	wgl .3?	wgl .3	Slight Improvement
			L. 50	2-18-20	3-27-20	wgl .5?	wgl .5	
P.	Mrs. F. S.	58	R. 190	10-16-19	4-12-20	wgl .2	wgl .6	Improved
P.	Mr. F. C. F.	23	R. 30	10-23-19	12-11-19	.6	.8	Improved
			L. 30	10-23-19	12-11-19	.6	.8	
C.	Mr. A. A.	63	R. 50	1-26-20	3-9-20	.3	.4	Improved
C.	Mrs. F. C.	62	R. 65	11-10-19	2-17-20	fingers 10 ft.	fingers 16 ft.	Slight Improvement
C.	Mr. K. C.	56	L. 45	2-12-20	3-19-20	.5-2	.5-1	Slight Improvement
C.	Mrs. E. G.	30	R. 110	8-29-19	3-12-20	.2	.5-2	Improved
			L. 110	8-29-19	3-12-20	.1	.1	Not Improved
C.	Mrs. M. H.	65	L. 45	1-30-20	3-8-20	.5-1	.5-2	Slight Decrease
C.	Mr. G. J.	64	L. 55	1-2-20	3-11-20	.6-2	.6-1	Slightly Improved
C.	Mr. C. R.	51	R. 30	1-29-20	3-15-20	.2	.2	No Improvement
C.	Mr. A. S.	58	L. 200	8-19-19	3-11-20	.5	1.2-3	Improved
C.	Mrs. B. A.	55	R. 25	1-28-20	3-10-20	.1	.2	Slightly Improved
			L. 25	1-28-20	3-10-20	.1?	.2?	
C.	Mr. T. H.	64	L. 30	8-21-19	8-28-19	.2	.1	Worse

P—Private.
C—Clinic.

THREE UNUSUAL CASES OF FOREIGN BODIES IN AND ABOUT THE EYEBALL.

FREDERICK T. TOOKE,

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This paper reports three cases of foreign bodies long retained in or near the eye, and illustrates the importance of careful examination for the possible presence of such foreign bodies and the benefits to be secured by their removal even in eyes regarded as lost. Read before the American Ophthalmological Society, June 16th, 1920.

In the prosecution of any war of modern times the sciences have derived not only a spontaneous or immediate inspiration, but also a subsequent recorded account of the achievement of premeditated as well as of unpremeditated endeavor. In no branch is this more true than in medicine: for war produces certain problems almost unknown in times of peace, the solutions of which have their own peculiar subsequent application and consideration in civil life. Besides creating fields of special investigation, war between civilized nations has the peculiar tho possibly remote benefit of having all its findings definitely and systematically recorded. The findings of the Army Medical Corps of all the forces engaged in the recent European campaign should, thru a more or less comparable system, prompted and stimulated by most unusual conditions, provide an abundance of classified information almost unobtainable under the ordinary conditions of civil life.

In referring to the subject of foreign bodies in and about the eyeball, doubtless a great deal of valuable information will be supplied when all material is gathered together from the various ophthalmic units of the allied forces. I am bringing forward the following three cases, not with the presumption of exhausting a very extensive subject, but rather to place on record instances which seem to me to deserve special recognition and consideration. Two of the cases were under my care in the Military Wards of the Royal Victoria Hospital, Montreal, while the third case was a civilian in the general ophthalmic ward of the same institution.

CASES.

CASE 1. G. D. Canadian, age 35, a man of large physique, enlisted for Overseas service in the 87th Battalion. After the usual period of training he was sent to France where he took part in several engagements. In the last one he had been selected as a bomber, and was rushing a German dugout. Thru excitement or anxiety, a hand grenade burst before he had time to hurl it from him. The right hand and forearm were shattered, the right eye torn to shreds, and the left eye blinded. The remains of the right eye were enucleated at a base hospital, the day he was injured. A large piece of steel was also removed from the left eye.

He was sent to England where he received treatment in two hospitals, an enucleation of the remaining eye being at one time considered on account of pain and inflammation. The patient was ultimately transferred to the Canadian Eye Hospital at Westcliffe, where the recorded vision was shadows only. No treatment being deemed advisable, he was sent to St. Dunstan's School for blinded soldiers, under Sir Arthur Pearson, where he remained for six months. He was ultimately returned to Canada two years after the accident as the first of a nucleus for an annex of that institution in our country. In the course of transit he was held over at the Royal Victoria Hospital where he came under my service.

The lids and conjunctivae were normal, the movements of the eyeball were free while there were a few powder grains embedded in the cornea. There was a scar of the cornea at the limbus at the nasal side above, with an underlying iridodialysis. This was doubtless the point where the foreign body entered and where it was subsequently extracted. The anterior chamber was of normal depth, while

the pupil was completely occupied by cortical and capsular remains, into which the iris had been dragged down by dense bands of postinflammatory tissue. One of these bands seemed to be particularly dense extending downward from the upper nasal quadrant. The eye presented a picture of what must have formerly been an intense traumatic iridocyclitis. Indeed, the patient had complained of black spots floating before his vision, but recently he had observed that this had not been as coarse as formerly. Tension of the eyeball was not soft, and projection of light was active in all directions. An X-ray photograph was made which showed about 16 small foreign bodies varying from 2 to 6 mm., within the orbit. About 6 of these seemed to be particularly suspicious, and after localization were decided to be extraocular.

After a culture of the conjunctiva was taken a subconjunctival needling was done in a V shape above, cutting thru the band of inflammatory tissue as well as thru the remains of the lens and capsule. There was remarkably little reaction following the operation. Two days after operation he was able to recognize my features, with a +10. D. lens. Four days later he saw his wife for the first time, he having married her after he had become blind. One week later he could tell the time by the wrist watch. Today, one year after his operation he sees 6/12+ and Jaeger 2. He is able to distinguish people on the street, attends the theatre with pleasure and is following the vocation of salesman.

Case 2. C. G., Canadian, sturdy and well developed, enlisted in the 22nd Battalion early in the war. He saw active service at Ypres, St. Loye, Camelle, and Descabuche, finally being wounded at Courcellette, in September, 1916. Regarding his eye, all that he at first experienced was a slight stinging sensation without any actual pain; and he carried on until enforced by subsequent wounds to be sent to the rear. He was treated at Boulogne and subsequently transferred to England, where six pieces of shrapnel were removed from the side of the neck. Altho the injured eye was blind, little attention seems to have been paid to it as it was neither inflamed or painful. He was returned to Canada unfit for further military duty and was subsequently admitted to the Military wards of the Royal Victoria Hospital, as the eye had become painful, two years after his being wounded.

The lids and conjunctiva were normal, manifesting no evidence of any measurable wound. There was some circumcorneal injection and the eye was slightly tender on pressure. The anterior chamber was abolished, the iris lying directly against the inner layer of the cornea. The pupil which was not dilated was inactive to light, while the lens was gray or cataractous. Tension registered 60 mg. of Hg. with the Schiötz tonometer. Vision was reduced to bare light perception, while light projection was problematic. An X-ray photograph was taken showing a small foreign body 16 mm. back, 8 mm. to the nasal side and 5 mm. below.

Under local anesthesia the patient was subjected to the Haab magnet, but under a moderate current failed to respond. On applying the full current no further encouragement was met with. However, by making and breaking the current at full strength the piece of steel was finally jerked thru the cataractous lens substance and could be noticed jammed up against the back of the iris above. It was impossible to draw it down, owing to the abolition of the anterior and posterior chambers thru the glaucomatous process. With a specially selected Graefe knife, an unusually narrow one, I managed to enter the chamber engaging the iris at the same time in a satisfactory corneal section. Lancaster's hand magnet was then introduced into the eye and a small foreign body was extracted with the greatest ease. It measured 1 by 3 mm. The idiectomy having already been performed at the time of the corneal incision, the soft lens matter was then removed with subsequent irrigation resulting in a perfectly clear pupil. The eye cleared up with unusually little reaction, a nor-

mal anterior chamber was soon formed and tension with the use of atropin was normal. One month after operation a clear view could be had of the fundus which showed a moderate degree of cupping in the disc with dipping of the veins. His subsequent visual acuity was 6/12 and tension 23 mm.

Case 3. M. L. D., an American residing in the northern part of New York State consulted me for pain and redness in the left eye, which he first noticed two weeks prior to his visit. He would observe the symptoms generally when getting up in the morning when the redness seemed to be associated with a dull pain at the back of the eyeball. He consulted an eye specialist at home who recommended the use of atropin drops, but he otherwise paid little attention to the condition. Bright lights troubled him at times, but there was no lacrimation. There was a slight degree of smarting of the healthy eye.

The history of the case was that when going to school, fourteen years earlier, he had been struck by a small fragment of screw at which he had been chopping. The sight was lost almost at once. He had periodic attacks of pain at the back of the eye, about once a year since the date of the accident. The eye was never red.

On examination the eye manifested considerable lacrimation but no photophobia. There was marked circumcorneal injection. One could see a definite small scar in the cornea about the middle of the pupillary area. An iridodenesis was present, with an anterior chamber of moderate depth. There was no sign of keratitis punctata, nor evidence of any kind of secretion in the anterior chamber. The pupil was regular, the vitreous was filled with coarse opacities, probably broken down particles of lens, while the optic disc could be clearly seen, apparently deeply cupped. This condition appeared to be physiologic, as there was no sign of a vessel emerging from the center of the nervehead. Tension was normal, and no tenderness could be elicited over the ciliary body. Vision consisted in counting figures at 1 foot, while the field of vision could not be estimated.

The man was sent to the Royal Victoria Hospital to have an X-ray photograph taken, and he presented himself for further examination the following morning. On this occasion, much to my surprise, a definite foreign body could be distinctly made out in the lower filtration angle, moving about in the aqueous with the change in position of the head. He told me that he had been in the habit of sleeping on his chest with his face buried in the pillow, which fact must have accounted for the foreign body working thru the pupil during the night. It was certainly not in the anterior chamber the day previous. I instilled eserin into the eye, reducing the pupil to the smallest possible dimension, referring him back to the hospital in the meantime with instructions not to lie down.

The same afternoon I operated with the patient in the semierect position, making an incision at the limbus below directly over the foreign body. I inserted the fine tip of a Lancaster hand magnet into the chamber, expecting the extraction to be an unusually easy one. But the reverse was the case. As soon as the tip of the magnet came in contact with the foreign body, when the current was turned on the foreign body spun about like a top. This behaviour was later explained by the splinter being composed in the main of a tiny central core of actual steel, the bulk of it consisting of rust. It was finally removed by a pair of iris forceps after breaking into two parts. Recovery was uneventful. On his return to Montreal a year later the eye was quiet, there was no iritis, a complete separation of the retina was present which doubtless existed prior to operation, and tension was normal. The right eye was healthy in all particulars.

In the Transaction of the Ophthalmological Society of the United Kingdom for 1916, there appeared a very complete and extensive discussion on the subject of foreign bodies in the eye and orbit, with special reference to prognosis and treatment. Altho the subject was treated in the greatest de-

tail the various speakers confessed that their experience had, up to that time been confined to accidents occurring during civil life. Practically all were agreed that heretofore opportunities had not been afforded them of making first hand observations on military cases. The exigencies of circumstances frequently caused, if not actually rendered the enucleation of an eyeball imperative before a patient could be returned to England.

The error of the too hasty enucleation of an eyeball, even tho blinded, was pointed out from the results of subsequent examinations at ophthalmic centers, when a foreign body would be found embedded in the deep tissues of the orbit after having penetrated the globe. Case 1 may be a possible example. This criticism is, however, in my experience sometimes unfair; for at Halifax I frequently found eyes completely destroyed by retained glass with additional fragments within the orbit. Besides, one must be charitable in our criticism of enucleations, remembering always a very much damaged eye on the one hand and the absence of an expert radiographer in the average field hospital. I have had men return under my care to Canada in this condition, with a presenting foreign body in the orbit, the eye having already been removed for reasons which I have just attempted to explain.

The contributors to this symposium were agreed that industrial and military experiences were quite dissimilar in this respect, in that the former class of cases consisted as a rule of a solitary foreign body within the eye or orbit. On the other hand in military cases, as in my cases 1 and 2, only too often there may have been one or more than one foreign body in the eyeball, with innumerable other small particles closely associated with it in the orbit or about the lids and face. I would refer you to Mr. Gray Clegg's series of 830 industrial cases reported and tabulated in detail from the Royal Eye Hospital, Manchester, as particularly interesting and instructive.

One conclusion arrived at, and one that can be applied to cases 2 and 3 in the present paper, is that if a small foreign body has not penetrated the danger zone it may frequently remain within the eyeball for years without creating sympathetic disturbance. Sympathetic irritation, according to Parsons, is too often the result of meddlesome interference in attempting to remove a foreign body, rather than the disturbance caused by that foreign body itself. Mr. Collins reported one case that began to give trouble only after thirteen years. My last case went thirteen years before he felt any acute disturbance in the eyeball and still retained his eye. A great deal of sensible advice was given regarding the choice of a magnet. The huge Haab instrument, tho often of the greatest value may do irreparable damage, the fact of using such force being frequently responsible for continued irritation resulting in the subsequent enucleation of an eyeball. One speaker referred to an instance exactly comparable to case 1, but he dreaded the responsibility of a needling, fearing the excitement of an iridocyclitis in a man with only one eye.

Another point on which many were agreed was, that if conditions warranted it, a magnet extraction should be attempted as early as possible after the accident, the localization of the foreign body being of secondary importance to the possibility of removing the steel, perhaps thru the original wound before adhesions had formed around the foreign body. Mr. Hill Griffith preferred when possible to draw the foreign body thru the circumlental space and to extract it thru the anterior chamber. He considered that a scleral section courted a separation of the retina.

But much water has flowed under the bridge since these views were expressed, at least from a point of view of military experience; and doubtless in the course of time other cases will be reported by various army oculists, in many respects similar to those which I have had the privilege of presenting before this Society.

RECURRENT RETINAL HEMORRHAGES.

WILLIAM ZENTMAYER, M.D.

PHILADELPHIA.

This paper states the characteristics of this symptom complex, gives the writer's own experience of it, four cases, and discusses the different views held with regard to its etiology and pathology, diagnosis and treatment, and advances the view that disturbance of function of the endocrin organs is an etiologic factor. Read by invitation before the New England Ophthalmological Society, April 20th, 1920.

The disease originally described by v. Graefe, to which Eales gave the name "Recurrent Retinal Hemorrhages," is one of unusual interest, one might say fascination, because of its distressing features; affecting as it usually does, young men who have previously been in fair health, the attack coming on with alarming suddenness and running a long course with alternating periods of hopefulness and depression, both to the patient and physician, and terminating only too frequently in partial or total blindness. It has seemed worth while to reread the original papers by Eales that we may have a clear conception of the clinical features of the cases which he recognized as a clinical entity.

Too often latter-day descriptions have been shorn of important and sometimes, essential features, as each succeeding systematic writer has used as his source of information an abstract quoted by some previous compiler. An excellent illustration of how far afield writers of books may thus be lead from the original descriptions and in the perpetuation of an error is the recent exposure that there is not one American text book and only one or two in any language, but have an entirely erroneous description of Gunn's dots. In consulting the literature of the disease under consideration it has seemed to me that cases have been described under this head that differ in many of the striking particulars of Eales disease; and the conclusion is forced upon one that, tho they may be allied conditions, some underlying factor is either different or wanting. The cases which I have to report conform in their essential details to the cases upon which Eales built up the symptom complex with which his name is linked.

The features of the disease as described by Eales are taken from a study of seven cases. All the patients were males ranging in age from 14 to 20 years. They were dyspeptic, low spirited, wanting in energy and complained of frontal headache, expistaxis and constipation. The pulse rate was habitually under 60, altho in the interval of ocular and nasal hemorrhage it might rise to 72. The number and proportion of blood cells was normal. The exciting causes of the intraocular bleeding were recumbent posture, stooping, coughing and laughing. In three of the cases the fathers had epistaxis. In all of this group the left eye was primarily and chiefly affected. When first seen the vitreous was opaque from hemorrhage and the fundus was either invisible or visible thruout a small portion of the upper part of the periphery, and here extravasated blood was found in the retina. There was often a rapid diminution of the opacity of the vitreous followed by a sudden recurrence of the opacity from fresh hemorrhage after a few weeks or months. Many such recurrences took place. In each case vision seemed to suffer only in proportion to the opacity of the vitreous. Between the attacks it sometimes recovered its normal acuity altho vitreous shreds were discoverable. The vessels in each eye were large and tortuous, especially the veins which were also remarkably dark colored. The hemorrhages were confined almost entirely to the extreme periphery of the retina. The extravasations were almost always large and round, and bleeding could often be seen to proceed from venous radicles. In one case glaucoma supervened. He also notes the tendency for the formation of vascular membranes in the vitreous.

Many cases have been reported in literature since the appearance of this admirable contribution, and so far as the ocular findings and clinical course are concerned, little has been taken from or added to it. The female sex has been found not to be immune and probably too much stress was laid on the dominant participation of the left eye; altho in my experience that eye has suffered the more.

CASES.

CASE 1. A. B. First seen Feb., 1917. Male age 18 years. History of sudden impairment of vision in L. E., 10 months ago. Cleared up in a month's time. For ten years previous to this he had noticed a streak in front of this eye. Present trouble about 6 weeks, in L. E. and a few days in R. E. No serious illness. Measles and scarlet fever. Does not use tobacco or alcohol. Parents living and well. Two sisters well. Feels well. No epistaxis. Physical examination by Dr. M. H. Fussell. Large fat individual. Pulse 82. B. P. 140—75. No enlargement of thyroid. Blood—hemoglobin 78% R. B. C. 4,020,000; W. B. C. 9000; Polys. 67%, Lymphs 28%; Large 5%. Blood nitrogen .016 per litre. Tuberculin, v. Pirquet positive. Wassermann negative. Coagulation from normal, to slow. Phys. Exam. Other respects normal. While in hospital pulse ranged from 68 to 89. T. 99—101°. When first seen Feb., 1917, V. R. E. 5/7.5; L. E. Hand movements at 1/3 M. Vitreous so opaque no fundus reflex. R. E. Vitreous filled with fine opacities. In the region of the ora serrata there was a zone of hemorrhages in the retina. The inferior retinal vein was greatly distended.

Field of V. R. E. Two rather deep reëntering angles above. L. E. Entire upper field gone.

By Sept., 1917, V. in L. E. nearly normal; R. E. 5/50. Beginning formation of new tissue over temporal border of disc. In July, 1918, V. L. E. 5/5; R. E. unchanged. By Oct. V. L. E. 6/6; R. E. 5/9. The proliferating tissue has greatly increased. Vision continued to improve in L. E. and when last tested March, 1919—5/4; R. E. 5/20. (Patient reported April 17, 1920.) V. R. E. counts fingers. L. E. 6/6. Mass of proliferation tissue and probable detached retina. Has had one attack of nose bleed. Present weight nearly 200 lbs.

CASE 2. E. B., female, married, age 33 years. (Patient of Dr. W. T. Shoemaker.) First seen April, 1917. Father and mother living and well. Five brothers and sisters. No history of tuberculosis. Has been married 5 years. One child living and well. One miscarriage. She had had the usual diseases of childhood.

Phys. Exam. Well nourished. Wassermann negative. X-ray of sinuses chest and teeth, negative. Urinalysis negative. No record of tuberculin test.

Blood Exam. Hem. 74%, R. B. C. 3,740,000. W. B. C. 50600; Polys, 50%, Lymphs. 42%. Coag. time 12 min. B. P. 115—65.

Eye trouble dates from Aug., 1914, when the left eye was hit by a tennis ball. Some time after this vision of left eye was lost but was later recovered. This again occurred but recovery was not so complete. Recently again lost it. Thinks R. E. now failing.

When first seen by Dr. Z. May, 1917, V. R. E. 20/50; L. E. 1/100. In R. E. marked proliferating retinitis. L. E. Vitreous filled with blood. While under treatment vision of R. E. fluctuated greatly, but there was practically no change in that of L. E. up to the time of using fibrolysin in Jan., 1918, at which date it was reduced to l. p. After one month's use of fibrolysin it again=1/100. Indirectly it is learned that at the present time the patient has had relapses in R. E. which have reduced the vision.

CASE 3. A. S., male, age 23 years. Seen in consultation with Dr. P. H. Kleinhans, of Bethlehem, Pa., April, 1918. Vision failing in R. E. since Feb., in L. E. for few days. Has had no serious illness. Tuberculosis on his mother's side. Parents living and well. Four sisters and 2 brothers living and well. One sister died of spinal meningitis, at 20 months and one of "throat consumption" at 5 months. No epistaxis. Constipated. Is gaining weight (140 lbs.).

v. Pirquet and Wassermann negative. The blood was normal except for a slight simple anemia. Coag. time of blood 5 minutes. Physical examination negative.

V. R. E.=1/60, L. E. 15/30. In R. E. central and lower part of vitreous is so dense that no fundus details are possible, elsewhere a red reflex is obtained; and to the nasal side a proliferating mass is visible. L. E. Several retinal hemorrhages in peripapillary region. In July, 1918, V. each eye about normal. Sept., 1919, V. R. E. 20/70; L. E. 1/200 eccentric. R. E. showed large sheets of hyperplastic tissue. L. E. Vitreous almost filled with blood.

At this time a subcutaneous tuberculin test was made and proved negative. April, 1920, Dr. Kleinhans reports that the patient now weighs 165 lbs. (height about 5 ft. 9 in). Since above date has had many vicissitudes and at present V.=5/21 each eye. In R. E. the retina is detached up and out. L. E. Vitreous very hazy, no fundus lesions made out.

Case 4. J. M., male. April, 1918, a cloud came before R. E. First seen by Dr. Gemmell of Monessen, Pa., who reported that V. at that time was; R. E. 6/40; L. E. 6/6. One month later it had fallen in L. E. to 6/40 due to an extensive hemorrhage. He was later under the care of Dr. Burke and also Dr. Greene, of Washington, D. C. When seen by me Oct. 14, 1919. R. E. 5/35; L. E. hand movements at 3/4 M. He was the youngest of a family of 2 males and 2 females. All living and well. His mother died in a few minutes of hemorrhage from nose and mouth. Father living and healthy.

Physical examination: 5 ft. 3 in. Weight 132 lbs. Bones of lower part of face heavy. v. Pirquet positive. Wassermann negative. Skiagraph of skull nothing abnormal. Urinanalysis normal. Blood—Slight anemia. Coag. time slightly increased to normal. Pulse ranged from 72—120. Temperature from 97.4° to 99.4°. L. E. Divergent. R. E. Numerous hemorrhagic opacities in vitreous. Periphery of fundus visible and shows some organized tissues. L. E. No red glare from pupil. At end of one week V.=R. E. 5/12; L. E. Fingers at 1/3 M. End of 2 weeks R. E. 6/6 pt. L. E. Unchanged. At this date tuberculin injections were begun, and 10 days later V. in R. E. had fallen to 1/60. Subsequently it temporarily rose to 5/4 and when last tested, 5 days later, was 5/9. Two months later the patient sailed for Italy and wrote that vision seemed about the same.

In all of these four cases the Wassermann was negative. In 2 the tuberculin test was positive, in one negative and in one not recorded. Blood pressure was normal in all. Coagulation time of blood was normal in 2 and slow in 2. The blood count showed no marked alteration. Hemoglobin was below normal in all.

In all four cases the treatment was much the same as will be spoken of later. The effect of treatment was uncertain, as fluctuations in vision dependent upon hemorrhages occurred and one eye would improve and the other grow worse despite the nature of the treatment. In the second case, because of the failure of the left eye to improve while the right continued to fail, it was decided to try fibrolysin. As the patient lived at a distance and intended shortly to return home it was deemed expedient to use every other method which offered any hope at the same time. Twelve doses of 2.3 cc. of fibrolysin were given in the course of a month. At the same time subconjunctival injections of salt and of dionin were used. At the end of this time V. R. E. remained unchanged, that of L. E. had improved from l. p. to 1/100.

Etiology. The predisposing causes which stand out in this disease are age and sex. The age limits at which it occurs in males fall within the period of adolescence. In the vast majority of cases the male sex is afflicted. The nature of the underlying cause of the bleeding is not so definitely determined. The views held by the earlier observers as to the fundamental causes are probably due to the limitations of research of the period. Eales originally attributed the condition to autointoxication resulting from constipa-

tion; but in his second paper was more speculative and viewed the condition as a neurosis affecting both the circulatory and digestive systems—a vasomotor contraction of the vessels of the alimentary canal resulting in a compensatory dilatation of the systemic capillaries. Nettleship's idea that gout was the cause is hardly tenable at this day.

The researches of Stock and Axenfeld, which have thrown so much light on the tuberculous nature of certain types of endophlebitis have led to the acceptance of tuberculosis as the cause of the type of intraocular hemorrhage with which we are dealing. According to Knapp the tuberculous nature of recurrent vitreous and retinal hemorrhages was developed entirely from clinical factors, positive tuberculin reaction, presence of tuberculous lesions in other parts of the eye and in the rest of the body. The tuberculous origin is often supported by the family history and the previous history of the patient. Axenfeld suggests that where vitreous hemorrhages occur without previous appearance of tuberculosis of the eye, they may be due to tuberculous involvement of the retinal vessels either directly or indirectly by the toxins of the bacilli.

The clinical histories in many of the reported cases are not definite enough upon the question of the manifestations of tuberculosis from which to draw conclusions. Among 25 case reports, in less than 20 per cent there was either no statement as to the clinical or laboratory evidences of tuberculosis or it was noted as absent. Perhaps no better summary of the evidence favoring tuberculosis as the cause, could be had than that of Jackson, who concludes "that in the well recognized association of intraocular hemorrhage and subsequent connective tissue formation, constituting retinitis proliferans, we have the same association of pathologic processes as in tuberculous lesions in general. The few cases that have been studied anatomically, the responsiveness of a large number of cases to the specific tuberculin test, and the relative recoveries that are now recorded to the credit of the recognized treatment of tuberculosis, give sufficient basis for the view that tuberculosis, chiefly of the retinal vessels, is the essential nature of the clinical condition, represented by cases of recurrent retinal hemorrhages in young persons, followed by retinitis proliferans."

The view that seems to meet with most favor is that the disease is an autotoxic one, the source of the toxemia being in most cases the intestines. As the result of this toxemia, inequalities of the circulation occur either too high or too low blood pressure. Many clinicians of authority seem not to be strongly impressed by the tuberculous view. Thus Fuchs and also Römer consider the nature of the affection unknown. Collins believes that the coagulability of the blood is raised, and that this leads to the formation of thrombi in the venules which rupture as the result of the vis a tergo.

Nieden believes the cause to be slow development of the sexual apparatus, in these cases unrelieved, as in females by menstruation. This view is also held by Koenigin; and Panas believes that the nature of the disease is the same as epistaxis. The latter even suggesting the name "epistaxis interoculaire." Both Nieden and Panas evidently agree with Hutchinson and Eales in considering the blood pressure an important factor as they state that by studying the sphygmographic tracings of the pulse we can not only determine the cause of the difficuty, but tell the prognosis very accurately.

There is some difference of opinion as to the source of the bleeding. Mostly it appears to come from the retinal venules. Nieden, however, believes that it comes from the choroidal vessels, and an anatomic study by Brewster confirmed this view. In other cases it seems to come from the vessels of the ciliary body. Eales attributes the more frequent involvement of the left eye to the origin of the left common carotid direct from the arch of the aorta, and the more circuitous route of the innominate vein, both favoring a higher vascular tension. Both Eales

and Nieden believe that the menstrual function acting as a safeguard accounts for the rarity of the condition in females. Schweigger denies the correctness of both of these clinical points, as to the preponderance of male sex and of the left eye, but recorded cases bear out Eales.

PATHOLOGY. Very recently Fuchs has recorded the anatomic changes which he observed in a large number of vitreous hemorrhages of spontaneous origin. The hemorrhage occurred on the outer surface of the vitreous, in the posterior lenticular and orbicular spaces and into the vitreous itself. In rare cases they were confined to the outer limiting layer, the blood corpuscles being within the lamellar structure of this layer, or they were spread immediately under it, coming usually from the ciliary region, or they penetrated into the interior of the vitreous. The change in the hemorrhages most frequently noted was hemolysis, i. e., exit of hemoglobin and lipoid from the corpuscles. This process takes place within a month of the time the hemorrhage appears in the vitreous, but does not occur uniformly.

There is no reaction in the vitreous as the result of the presence of the hemorrhage or its derivatives. The absorption of the blood is in part effected by phagocytosis, but in case of large hemorrhages absorption is due more to hemolysis and the formation and the removal of the granules, or where the hemorrhage is traversed by connective tissue the gradual disappearance of the corpuscles enclosed in its meshes. The formation of connective tissue begins from the ciliary body or the retina and is more likely to occur when beside the hemorrhage there is some inflammatory reaction. It was first seen fourteen days after the occurence of the hemorrhage in the form of fibroblasts going in towards the blood, then in between the corpuscles to form long narrow threads or membranes. In other cases the connective tissue is developed on the surface of the hemorrhage, making a membrane around it. This formation of tissue may go on with or without phagocytosis.

Schreiber found that the greater part of blood injected into the vitreous disintegrated at once at the site of the injection and was taken up by migratory cells from the ciliary processes and the perivascular lymph spaces of the central vessels, while the anterior chamber took no part. In the greater number of cases in the course of one or two weeks there could be demonstrated connective tissue formation presenting the microscopic picture of retinitis proliferans. Some reaction of the neuroglia is seen at the points where groups of hemosiderin containing migratory cells accumulate in the retina; this usually occurs in the lower part. Here also is seen glial proliferation of Müller's fibres. The connective tissue formation of the papilla plays the most important part in the development of retinitis proliferans. Parsons holds the same opinion as to the part played by the mesoblastic tissue of the papilla in the reparative reaction.

Sugamuma concludes that the newly formed tissue in proliferating retinitis results from a proliferation of the retinal glial fibres as well as connective tissue subsequent to hemorrhages.

PROGNOSIS. The prognosis of the disease is grave. As stated by Roemer it is very remarkable how rapidly the resorption of such hemorrhages takes place, while that of an ordinary hemorrhage is wretchedly slow and incomplete. (I think that this is sometimes due to the slow coagulability of the blood in this affection.) But unfortunately there is the marked tendency to the formation of connective tissue membranes, which not only cover portions of the retina but may cause its detachment.

TREATMENT. The treatment resolves itself into an attempt to prevent the recurrence of the hemorrhages and to bring about the absorption of the extravasated blood. There is considerable testimony as to the curative value of tuberculin in the cases in which tuberculosis was the cause or an associated condition. Alterative drugs such as iodid of potassium, Donovan's solution, syrup of the iodid of iron and syrup of hydriodic acid in large doses,

seem all to be of some value. Darier advises the use of vasoconstrictors.

Ormond, Ollendorff, Thilliez, Westphal, Lamb and others have had sufficient success with fibrolysin to recommend its use. In one case in which I used it the effect was negligible. Bennett, in a typical case with retinitis proliferans where practical blindness had resulted and all of the usual drugs, including fibrolysin, were of no avail, secured a permanent improvement to 6/6 and 6/18 after 3 weeks use of thyroid.

I have thought that the use of thyroid extract was of real value. The use of radium is of doubtful utility, because the greater resistance of connective tissue cells than epithelial cells to its influence possesses an element of danger.

In view of the variability of many of the factors that have been considered as of possible etiologic importance; the very definite picture of tuberculosis of the retina not usually found in these cases; the fairly constant age incident, that is, adolescence, in the cases occurring in males; the physical condition of the patients as described by Eales and present in some of my cases—lassitude, low spirits, variations in local temperature, cold hands and feet, in other words, asthenia, the tendency to over size in 3 of my cases, and the beneficial effect of thyroid in the treatment of the disease, the thought has long been in my mind that disturbed secretion of some of the ductless glands may be an important etiologic factor. As the activities of the endocrin organs are interlocking it would be impossible probably to indicate definitely the one at fault, altho the symptoms point to the adrenals as the primary one.

In connection with another hemorrhagic affection, Moret speaks of the cause as being probably an interference with the angiotonic functioning of the ductless glands, probably the adrenals. In discussing this idea with Sajous he stated that the adrenal secretion acts directly on the arterioles and sustains their tone, and further that this function when deficient, owing to relaxation of these precapillary vessels may represent in "Recurrent Vitreous Hemorrhages of Adolescence" an indirect cause of the hemorrhages. He further pointed out that the sympathetic system is studded with adrenal medullary substance, supplied probably by the medullary portion of the adrenals, and says that "If this is true the sympathetic ocular supply must also suffer—another cause of vasodilatation, probably of the choroidal vessels."

I do not wish it to be understood that I wholly reject the tuberculous cause of this disease, but I do think that some other factor must be found to explain the striking characteristics of this group of cases and that this may be found in the adrenals, whether acting independently or in conjunction with tuberculosis. I merely put it out as a suggestion that should be borne in mind in the further study of this affection, tho it is well also to remember that, to paraphrase a recent sentence of MacRobert,—the endocrin organs possess a strange proclivity to evoke suspicion towards themselves as being the source of incomprehensible ailments.

RECURRENT RETINAL HEMORRHAGE OF ADOLESCENCE.

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This report of a case and comparison of it with a case previously reported by the same author was read before the American Ophthalmological Society, June 16, 1920.

In 1912 I reported before this society the case of a young man (F E. B., aged 22), where there were not only repeated and extensive hemorrhages into the vitreous, but a most pronounced perivasculitis especially affecting the veins, followed in each eye by proliferating retinitis, vascular veils, partial

detachment of the retinae with almost total loss of vision in the right eye (20/200) and complete loss of vision in the left eye. The present case, resembles the former case in that there were repeated vitreous hemorrhages followed by retinitis proliferans, detachment of the retina and loss of vision; but differs from it in two particulars, first, in that the optic nerves were affected, and second, in marked choroidal changes in both of the eyes. The full case report of number 1 (F. E. B.) may be found in the Trans. Amer. Opth. Soc. Vol. XIII, 1912., pp. 235-256. The report of the second case is as follows:

CASE.

E. W., aged 19 years, male, machinist. First consulted me June 25, 1918, giving the following history. One year previously the vision in the left eye was suddenly lost and the eye has remained blind since. As it caused him no pain he paid but little attention to it. Five days ago, the vision in the right eye was suddenly and all but completely lost; and, of necessity, he was compelled to seek advice.

Family history: Father had suffered from "bone tuberculosis" and died of brain tumor; Mother died of meningitis; has two brothers, one older, who has never been troubled with his eyes, and one younger, who has had trouble with one eye, the nature of which was not stated. The patient himself has enjoyed good health and continued to work at his trade as a machinist even after losing the sight in the left eye. He is a tall, slender, blond with a delicate skin and high color. Height, 5 ft. 11 in.; weight, 150 lbs. Temperature this morning 99°. Pulse 76.

Eye Examination: R. 10/200. Eccentrically L. perception of light.

Pupils normal in size and reaction, large central scotoma in right almost circular in shape. Opthalmoscopic examination shows: Right eye, retinal veins greatly enlarged and tortuous, with the arteries but slightly enlarged; the macular region is markedly edematous, and there are choroidal changes under and about the retinal veins (chorio-retinitis) in the upper and lower half of the fundus in the medial zone, and also in the peripheral temporal part of the fundus. Vitreous is clear.

Left eye: optic disc is elevated 3. D. the retinal veins are markedly enlarged and tortuous as also are the arteries, but to a lesser extent; there are very pronounced choroidal changes especially following the course of the blood vessels, being more pronounced at the periphery of the fundus where also the retina is involved. The retina and vitreous have connective tissue bands with blood vessels in them (retinitis proliferans), the retina itself being detached in spots far peripherally. There is one large spot of choroidal atrophy just below the optic disc and another further down near the periphery, some pigment is collected on one side of the upper and larger patch. Two small hemorrhages are present in the retina, on the temporal side far out at the periphery. The vitreous is clear of opacities. Tension normal, or slightly minus, in each eye.

June 29th, the von Pirquet test was only moderately positive, altho a fresh hemorrhage appeared in the left eye.

July 1st, gave O. T. subcutaneously. The second night following the injection, the patient had a severe chill and was unable to sleep. The arm was red at site of injection, and the temperature went to 99°.

July 6th, temperature 97.3; gave 2mg. O. T. The following day the patient waked up with a severe headache, pains in the back and legs and a feeling of weakness all over. Temperature 101.2°, pulse 100, arm greatly swollen and marked congestion in right fundus. Three fresh hemorrhages in the left fundus with increased swelling of the optic disc.

July 12th, six days following the second diagnostic injection of 2mg. of O. T. the patient feels much improved, temperature and pulse normal. The retinal hemorrhages in the left eye are almost completely absorbed, while the edema at the right macula is greatly reduced. V.=R. 15/70. Gave 2mg.

B. E., vial 1, (Mulford), that is 1/10,000 mg.

July 17, (17 days after the first subcutaneous injection was given) V.=R. 15/20 minus, L. l. p. The edema at macula in right has disappeared, leaving, however, some fine radiating dotted lines, star-shaped, at the macula. In the left the swelling about the optic disc has subsided, and but one small hemorrhage remains in the retina.

July 25th, (eight days later). While sitting still the vision in the right eye suddenly "faded out." When seen next day, the vision was reduced to counting fiingers, and the ophthalmoscope showed the vitreous full of blood. The left eye remains as when last examined. Tuberculin treatment was continued and the vision in the right eye came up to 16/70 after some months.

February 24th, 1919. Detachment of the lower half of retina in each eye, and retinitis proliferans well marked in peripheral portions of right were noted.

R.=Fingers at one foot, excentric.

L.=Perception of light.

The patient later came under the care of Dr. Charles Graef, of New York City, who has been kind enough to report what he did for him and the ultimate result, which I herewith append.

"July 8th, 1919. E. W. was brought to me a year after you first saw him, and for some time had been led about quite blind. I found a faint trace of light perception in the upper part of the right eye only; the retina widely detached and the interior so obscure that no more details could be made out. I did a trephining on the right eye six weeks ago and have had a very excellent result. The retina became replaced, the vitreous cleared, and he goes about the city now quite well alone. He has of course, only excentric vision, as the macula is blotted with old exudate. The veins which were very tortuous and swollen are improving very noticeably. He is highly delighted and has gone to the country for the summer."

May 23, 1920. "The later history of the boy is as follows, he went to the country some weeks after I operated on him, and retained useful vision for nearly three months. The detachment then recurred and he returned to me. He begged me to operate the eye again and I did so. This time I applied a cautery point to the trephine openings which I made in two places, hoping thus to get better and more lasting adhesion, but the operation was not a success and he lost his sight."

COMMENT.

In the two cases reported by me, it is of interest to note the points of similiarity, and also the features in which they varied. The former case, F. E. B., reported by me in 1912 before this society has been under my care since that date, and examined as late as May of this year, and the following note made. May 5, 1920. Patient had a sharp pain in his right eye last week which lasted almost an hour. Vision was not affected, R.=15/200, L.=light perception. Ophthalmoscope.: right eye shows floating specks in the vitreous; no hemorrhages, but, retinitis proliferans pronounced. Posterior cortical cataract developing. Left eye has mature secondary cataract. Tension normal in right; slightly plus in left. General condition of patient very good.

Points of Similarity, General: Both were males, young, slender, but well muscled, in perfect health until date of eye trouble. History of tuberculosis in family of each, negative history as to syphilis, gonorrhea, etc. Both reacted strongly to the tuberculin tests—general, local and focal.

Special: Each had recurrent retinal hemorrhages into the vitreous, retinitis proliferans and finally detachment of the retinas and loss of sight. Case 1, F. E. B., lost sight completely in one eye and maintained 15/200 only in the other, while Case 2, E. W., lost sight in both eyes.

Points of Variance: Case 1, F. E. B., (1) Had a pronounced perivasculitis from the start, the retinal vessels being affected from the disc to the extreme periphery of the fundus; (2) The optic nerve was little involved and secondarily;

Case 2, E. W., (1) Had no perivasculitis noted at any time; (2) The optic nerve was markedly involved in the left eye (+3D); and moderately so in the right, with pronounced edema at the macula; (3) pronounced choroidal changes especially in the left eye.

It seems therefore that we may have different types of the same disease, the main distinctive feature of which is the recurrent retinal hemorrhages. In fact, Siegrist[2] has described two types of the disease; in one, the veins, especially at the periphery, are involved; while the optic nerve and the veins in and near the optic nerve are not involved. In the other type the central veins and optic nerve are involved. Gilbert[3] is given credit for first describing the type where the nerve and central veins are chiefly involved. It would appear therefore that the first case (F. E. B.) reported by me falls under the first type, where the peripheral vessels are more involved; while the second case (E. W.), comes under the type of optic nerve and central vein involvement.

Etiology: Most observers are, I believe, in accord with the opinion expressed by Axenfield and Stock that many cases of recurrent juvenile hemorrhages are due to tuberculosis. However, Steffan[4] reports a case of hemorrhagic retinitis in a patient 23 years of age, who had acquired syphilis a year before, and it is suggested that syphilis may be an etiologic factor in rare cases. I would suggest also that it is possible in some cases that both tuberculosis and syphilis are etiologic factors. As but few such cases come to section, the cause of the disease in most instances must be arrived at by clinical observations, the tuberculin reaction tests, experiments and the history of the case.

Fleisher[5] reports a case in which one of the eyes of a patient suffering from this disease came to section, the eye having been removed because of secondary glaucoma It tended to confirm Axenfeld and Stock's opinion from a pathologic standpoint. The patient was a man, 36 years of age, suffering from pulmonary tuberculosis. The left eye was the first to be affected with periphlebitis and retinal hemorrhages, some patches of choroiditis being observed. The anterior portion of the eye was not affected. The hemorrhages absorbed and the phlebitis subsided. The second eye, however, was affected a year later, with nodular iritis, retinal hemorrhages and a pronounced periphlebitis. Because of a complicating glaucoma, the eye was removed.

Microscopic examination showed the disease in the iris and anterior part of the eye was most likely of tuberculous nature, also the changes about the retinal veins, where "typical groups of epithelioid and giant cells, in places showing slight necrosis, were present, forming nodules lying on one side of the vessel, or sheaths surrounding them, were considered to be tuberculous formations. This in spite of the fact that the tubercle bacilli could not be demonstrated. And, further, the case is supposed to prove that hemorrhages of this type are due to actual tuberculous foci, and not, as recent opinion has tended to assume, to tuberculous toxins."

Van Duyse[6] reports a case of recurrent retinal hemorrhages with periarteritis, polar cataract, and apparent neuro-retinitis, which he considered due to a "pathologic state of the internal secreting glands," tuberculosis and syphilis being excluded.

From the foregoing citations it will be seen that the etiology of this obscure disease still remains in doubt. However, the weight of opinion, based on clinical and experimental observations together with the tuberculin reaction tests and the few pathologic reports that have been made, leans heavily to tuberculosis as the chief cause. Occasionally other factors may enter into the etiology.

Treatment: Besides keeping the patient in the best physical and mental condition, unfortunately little can be done to alter or check the progress of the disease.

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OCULAR TUBERCULOSIS.

F. B. Bogardus, M.D.,

RUGBY, N. D.

A general survey of this subject here given, is lacking from text books in which it might be expected. With this survey the methods of diagnosis and treatment employed at Bellevue Hospital, New York City, and reports of four illustrative cases are included.

The manifestations of tuberculosis. which the ophthalmologist is called upon to diagnose or treat are located most frequently, in the choroid. The cornea, iris, ciliary body, and retina are not attacked so often, altho in a busy eye clinic, may cases of tuberculous anterior uveitis will be seen.

TUBERCULOSIS OF CHOROID.

Tuberculosis of the choroid occurs in three fairly distinct forms: choroiditis exudativa, miliary tubercle, conglobate tubercle. The first of these is not different in appearance from choroiditis due to other causes, and may be disseminated or discrete. It is the most frequent type. In the beginning of this disease, there is a formation of yellowish patches of exudate, over which the retinal vessels are seen to pass. These patches are located at any portion of the fundus. They may be single or multiple, and of various sizes.

When fresh the patches of exudate are not sharply outlined, but have a hazy, indistinct edge; quite different from the appearance in the later stage of atrophy, when the patch stands out clear cut and sharply defined, with a lining of black pigment. Early the color is somewhat yellowish, while later it is more of a pure white, due to exposure of the sclera. In some cases quite large areas of sclera are visible, due to coalescence of neighboring spots.

In many cases the disease becomes arrested, leaving only a small atrophic spot in the choroid, or sometimes the exudate may even be absorbed leaving the choroid intact. In other less favorable cases the disease progresses, vitreous opacities increase, the lens becomes opaque, the retina detached, and atrophy of the globe follows.

The symptoms relate mainly to vision, and vary from slight impairment to blindness. In the early stage of exudation there is irritability of the retina, with subjective sensations of light, balls of fire, and sparks before the eyes (Fuchs). Scotomata are present, affecting vision according to their location.

Miliary tubercles of the choroid are much rarer than the exudative type, in fact, they are among the diseases of the eye which are seldom seen. They are small patches of exudate, 0.5 to 1. millimeter in diameter, often multiple, and represent the typical miliary tubercle as found in any part of the body. With the ophthalmoscope, the growth of the tubercle may be observed in all its stages. At first a rapid growth is seen from day to day, of a yellowish, grayish exudate, with ill defined margins. Then the tubercle ceases to grow, and gradually the exudate is absorbed, leaving small round white areas in the choroid, which have a punched out appearance. Often there will be a deposit of fine grains of black pigment in the base and margins of these areas.

These tubercles of the choroid are not seen in apparently healthy persons as is the first type, but are found in patients with miliary tuberculosis, tuberculosis of the bones and joints, and tuberculous meningitis. They have great diagnostic importance, where miliary tuberculosis is suspected.

The conglobate tubercle of the choroid is a tuberculous nodule that often appears as a small tumor projecting out into the vitreous It may be hard to differentiate from a sarcoma of the choroid, or a neuroepithelioma of the retina. If the diagnosis is in doubt, the eye should be removed, since it is lost in either case, and an early enucleation is imperative if it should be sarcoma (1).

RETINAL TUBERCULOSIS.

The retinal tubercle has been lucidly described by Jackson in a recent paper (2). He states that it is usually connected with a vein or artery, most frequently the former. A yellowish spot appears, with indefinite margins and gradually covers over the affected vessel. It reaches its full size in a few days. When an artery is affected, it shows little change on either side of the exudate, but a vein will become dilated in limited portions so that these parts are three or four times the diameter of the normal vessel.

These retinal exudates after a time become vascularized and fade away in many cases, leaving the retina in the same condition as before the attack. In other cases the exudate is not entirely absorbed, but is converted into fibrous tissue, which has the characteristic shiny white appearance of retinal exudates in their later stages. There are also white spots in the macula such as are seen in albuminuric retinitis, which may later disappear leaving no trace.

Retinal tuberculosis is undoubtedly the most common cause of recurring retinal hemorrhage. When these hemorrhages become absorbed and replaced by shining bands of fibrous tissue, we have the condition known as retinitis proliferans.

TUBERCULOSIS OF ANTERIOR SEGMENT.

Tuberculosis of the anterior part of the eye is called tuberculous anterior uveitis. Its symptoms vary according to the structure most seriously involved. It may appear mainly as a keratitis, an iritis, an iridocyclitis, or an iridochoroiditis.

Tuberculous disease of the cornea usually resembles syphilitic interstitial keratitis so closely that a clinical differentiation is impossible. Here we have the deep infiltration and steamy condition, with formation of macules which characterize keratitis. Blood vessels penetrate into the cornea beneath its surface. In the tuberculous, as in other forms of keratitis, it is usual to have an involvement of the iris and ciliary body. When these are affected, we often have a sign that has great diagnostic value. It is the deposit of grayish spots of exudate on Descemet's membrane, which have the color of tallow. They are called mutton fat deposits, and usually mean tuberculosis.

As the iris partakes in the inflammation, it loses its lustre, and adheres to the lens. Miliary tubercles may sometimes be seen on it, as small grayish nodules. As the disease advances, occlusio pupillae occurs from organization of exudate in the pupillary area. As a further evidence of involvement of the ciliary body and choroid, we have the formation of floating opacities in the vitreous.

DIAGNOSIS.

The diagnosis of tuberculosis of the eye may at times be made clinically, especially in cases of anterior uveitis with mutton fat deposits on Descemet's membrane. Choroidal and retinal tubercles may be recognized with the ophthalmoscope. In the majority of cases, however, the diagnosis is arrived at by injections of tuberculin.

The diagnostic routine for such cases in the eye service at Bellevue Hospital, as ordered by Dr. May is as follows: The history is taken and then a thoro physical examination is made. After this the eye is examined, using oblique illumination, the loupe, and the ophthalmoscope. The paranasal sinuses are X-rayed. The tonsils are examined by retracting the anterior pillar. A blood Wassermann is done, and at times a spinal fluid. When this data is collected, and after it has been determined that there is no active tuberculosis as shown by a normal temperature for twenty-four hours, a diagnostic injection of O. T. is given at night. The amount given varies from 1/10 mg. in children to 1. mg. in adults. A rise of the temperature over 100° within twenty-four hours signifies a reaction. When none occurs, the dose is doubled and repeated in twenty-four hours. If no reaction occurs from this, a third dose is given, 48 hours later, of 5 mg. in adults, and children in proportion. If there is no rise in temperature, and no focal reaction, or no

local hypermia at the point of injection, tuberculosis is excluded. A focal reaction in the eye is diagnostic, while a general reaction with fever, without the focal reaction, is only suggestive.

The prognosis of tuberculosis of the eye is grave. A few cases of mild infection recover, leaving more or less damage. The more serious cases often go on to blindness, from corneal opacities, pupillary membranes, organized exudates in vitreous, and retinal detachment. The final stage is atrophy of the eyeball. In conglobate tubercle of the choroid perforation of the sclera may occur. With the therapeutic use of tuberculin many cases, which hitherto had been uncontrollable, have been brought to a standstill, and some really remarkable results from its use are reported by reliable observers.

TREATMENT.

In the treatment of tuberculosis, hygienic measures are of utmost importance. A high calorie feeding should be instituted, so that the patient takes the greatest amount of food he can assimilate. One or two quarts of milk should be given daily, if it agrees with the digestion. As much of the day as possible should be spent in the open air, but no violent exercise should be taken, nor should moderate exercises be taken to the point of tiring the patient. At night he should sleep in a tent or on a porch. The bowels should be regulated, and the digestion have careful attention.

All foci of infection should be removed when possible, even tho they appear to have no relation to the tuberculous process. Infected teeth are extracted, and suspicious tonsils are taken out The term "suspicious tonsil" is used, for infection may exist deep in the crypts where it is not easily demonstrated, and it is certain that infection is present, at times, which cannot be seen until after the tonsil is removed. Infected sinuses receive proper attention, and no condition is neglected which may be a menace to the general health

When tuberculous disease exists in lungs, bones or joints, the indications for treatment are modified in so far as made necessary by these conditions. Locally, atropin is useful as it puts the ciliary muscle at rest, in conformity with the principle that all tuberculous organs should be inactive until healing has occurred.

The specific treatment consists in injections of T R, and is given where the eye condition is the principal lesion. It is customary to start with a very small dose, depending somewhat upon the strength of the reaction to the diagnostic infection. If a prompt reaction follows the first diagnostic injection, the dose is smaller than if the reaction only occurred after the second or third dose. An average first dose is 1/50,000 milligrams. This is smaller than the dose given in some of the New York Eye Hospitals, but with this dose we have found that a focal reaction is extremely rare, while with a first dose of more than 1/50,000 mg., an unpleasant aggravation of the disease sometimes occurs It is most important in using tuberculin therapy at all times to avoid a marked focal reaction, for it may undo the improvement which has been gained after many weeks of painstaking care.

The dose is given every five days, and is gradually increased. Thus the second dose is 2/50,000 mg., the third 3/50,000 mg., and it is so increased that at the tenth dose the patient gets 1/5,000 mg. This is increased in the same ratio, until he gets 1/500 mg., and then 1/50 mg., always trying to keep below the point of reaction. If a focal or general reaction should occur, the dose must be reduced, and then cautiously increased again. A dose of .01 mg. once a week is not exceeded. These injections may have to be kept up for months, so that patient and physician, are apt to become discouraged. It is well to inform the patient on the start that quick results cannot be expected, altho in many cases rapid improvement does occur.

CASES.

The following cases seen in the wards of Bellevue Hospital represent some of the forms of ocular tuberculosis.

CASE 1. Miliary tubercle of choroid, with tuberculosis of lungs.

M. O. female, age 19 months, admitted to Bellevue, Feb. 9, 1920. Mother gave following history: Breast fed up to 15½ mo., also solid food from table. Constipated since six months of age. Has had a cough for last five months. For last ten days has been quite sick, with rapid respiration, vomiting and loss of weight.

Examination.—General condition poor with appearance of severe illness. Temp. 102, pulse 140. The right apex dull on percussion, with bronchial breathing, and moist rales on coughing. Tubercle bacilli found in sputum. On examining the left eye with the ophthalmoscope, a choroidal tubercle was seen to the left of the macula. It had a clover leaf appearance as if three tubercles were joined together and it was in the stage of regression or atrophy. The edges were sharply defined and tiny dots of black pigment were scattered over the whole base.

CASE II. Miliary tubercles of the choroid and acute general miliary tuberculosis.

P. D. female, age 13. Admitted March 7, 1920. This patient has had tuberculosis of the joints for the last eight years, which affected the hip, elbow and knee. Had an operation on right elbow four years ago, and has worn a hip brace for last two years. Four weeks ago was taken sick with symptoms of influenza, such as headache, cough, pains in back, coryza and fever. These lasted fourteen days, and gradually subsided. A few days later the neck became slightly stiff, headache returned, and she vomited occasionally. At times she would appear to be unconscious for an hour or more.

Examination.—On admission showed temp. of 102°, pulse 120, stupor, rigid neck, paralysis of left external rectus muscle, and dullness of right apex with bronchial breathing. The joints mentioned above were tuberculous, but there were no sinuses. Wassermann for blood and spinal fluid negative. Spinal fluid negative for tubercle bacilli. The urine contained much albumin, with coarse and fine granular casts. Blood showed leucocytes 10,000, polymorphonuclears 84%, transitionals 2%, lymphocytes 14%.

Examination of the right eye with ophthalmoscope showed two grayish white patches close together, just above the macula. Their outline was rather indistinct, and the diameter of each was about ⅓ the diameter of the disc. The left eye showed a similar patch, two disc diameters from the disc, close to the superior temporal vein, and another nasal to the macula. Retinal vessels appeared to be elevated where they passed over these tubercles. This patient died about seven days after admission.

CASE III. Tuberculous interstitial keratitis or anterior uveitis.

A. H. female, age 43. Admitted Oct. 31, 1919. Patient stated on admission that vision in right eye had been failing for the past seven months. Examination of the right eye showed moderate injection of palpebral and bulbar conjunctiva, also ciliary and episcleral injection. There were maculae in the cornea, near the limbus, at upper and outer parts. The whole cornea was slightly hazy. The iris was discolored, and reacted very sluggishly. The fundus was seen very indistinctly, due to the condition of the cornea, and was normal as far as could be determined. In this case the Wassermann was negative, and examination for a focus of infection in teeth, tonsils, sinuses, lungs, bones, joints, Fallopian tubes, did not reveal anything of importance. An injection of 0.5 mg. O. T. was given for diagnosis, and was followed by a rise in temperature to 101½ deg. within 18 hours. There was distinct focal reaction in the eye as well as local reaction at the point of infection. Therapeutic injections of tuberculin were instituted with the usual accessory measures. At the present time, five months later, the injections are still being given. The condition has greatly improved so that all evidence of irritation has about disappeared, altho we cannot pronounce her cured as yet.

CASE IV. Tuberculous iridocyclitis or anterior uveitis.

T. B. age 22. Admitted Nov. 8, 1919. Patient has had good eyes up till 18 mo. ago, when the right eye became painful. It has been irritated most of the time, until quite recently, when the irritation subsided. The sight in this eye has gradually failed, so that on admission, she has only perception of hand movements at two feet. The left eye became inflamed two months previous to admission, with pain, photophobia and lacrimation.

Examination.—Right eye showed atrophy of eyeball with diminished tension. Cornea clear with lower half of anterior chamber filled with a grayish exudate. Iris dull, atrophic and adherent to lens. Pupillary space occluded by a membrane.

Left eye showed circumcorneal injection with a bluish zone of deep hyperemia. Cornea clear, and on Descemet's membrane were the small mutton fat deposits. Iris hyperemic and swollen, and adherent to lens in places by fresh exudates. The lens itself was clear but opacities were seen in the vitreous. Fundus indistinct, but apparently normal. Vision 20/200.

In this case a blood Wassermann was negative. Infected tonsils were removed, and an injection of 0.5 mg. O. T. gave a positive focal and general reaction. Tuberculin was started in therapeutic doses and is still being given, with moderate slow improvement in the left eye.

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INTRADURAL TUMORS OF OPTIC NERVE WITH REPORT OF A CASE

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Cases of this condition are worthy of record both for their rarity and their clinical interest. With the report of such a case, studied in the Department of Pathology of the Ohio State University, there is here included a brief statement of our present knowledge regarding such tumors.

In discussing intradural tumors of the optic nerve Parsons gives a brief historical sketch, in which he states that Wishart in 1833 and Middlemore in 1838 were the first to report such cases and that Goldzieher in 1873 separated optic nerve tumors from the extradural orbital tumors. von Graefe in 1864 gave the main diagnostic points of such tumors, while Leber, in 1877, was the first to attempt the differentiation of tumors arising within the sheath of the nerve from those without. In 1901 Byers collected one hundred and two cases from the literature, which he subdivided upon a histologic basis. The most recent study of this class of tumors has been made by Hudson, who in 1912 collected one hundred and fifty-four cases. These he divided into three groups: (1) Gliomatosis, (2) fibromatosis of the nerve sheath, and (3) endothelial tumors of the nerve sheath, placing one hundred and eighteen of the cases in the first group and again subdividing this group into those designated as (a) gliomatosis, (b) probably gliomatosis, and (c) probably not gliomatosis. Under the second heading he placed six cases, the remaining cases falling under endothelial tumors of the sheath.

Such primary intradural tumors are met with most commonly during the earlier years of life, corresponding in this respect with the gliomatous tumors of the brain. Eighty-five of the cases cited by Byers gave exact data as to age; of these sixty-seven occurred in children before the fifteenth year, fifty per cent of the sixty-seven occurring before the fifth year, only four of

this series occurring subsequent to the twenty-fifth year of life. Because of this early age incidence and of the absence of any definite etiologic factor, it has become generally accepted that these tumors usually arise from some form of embryonal or congenital defect in the structure of the nerve tissue. In some instances, however, direct trauma is given as the exciting cause.

The usual symptoms presented by patients suffering from intradural tumors of the optic nerve are a slowly progressing exophthalmus which, in the majority of instances, is directly forward, and a gradually developing blindness. Movements of the eyeball are limited and pain is absent until the tumor has attained a considerable size. The ophthalmoscopic examination reveals an optic neuritis and a choked disc.

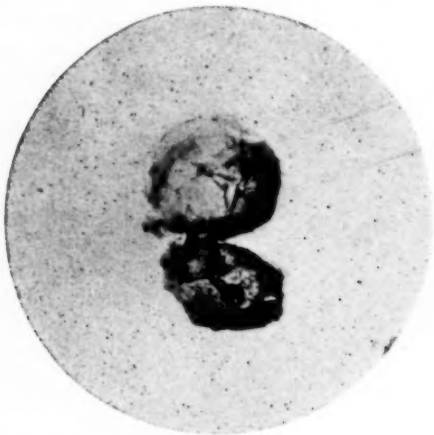

Fig. 1.—Photograph of eye with tumor of the nerve attached.

Fig. 2.—Photograph of eyeball after section with the tumor of the nerve.

Anatomically, the tumors are situated within the dural sheath of the optic nerve and are sharply differentiated, both macroscopically and microscopically, from tumors arising within the sheath itself or growing in the orbit outside the sheath The intradural tumors differ greatly in size, varying from a barely perceptible swelling in the course of the nerve to tumors 3 centimeters in diameter. The anterior portion of the nerve, or that portion in immediate proximity to the eyeball, is usually not involved, the main enlargement being found in the middle portion of the nerve; it may, however, involve that portion in the posterior part of the orbit and even extend into the intracranial portion of the nerve. The growths also vary markedly in consistency, some being quite firm and dense, others being soft and of a more gelatinous consistency. Ewing describes the structure of gliomas occurring in the brain substance, as consisting of "glia cells and glia fibers of various forms and in varying proportions. In many the typical spider cell is predominant. This cell has a small compact nucleus and a scanty cytoplasm, from which radiate numerous comparatively short fibers. In other cases the cells are larger and the fibers longer and less numerous. In certain tumors the cells are large and possess cytoplasmic processes containing large nuclei or multiple nuclei, and closely resemble ganglion cells." Tumors growing within the optic nerve, grouped under the head of gliomata, differ rather markedly from this description. These tumors contain the same small cell with dense nucleus and scanty cytoplasm. The cells, however, are rather widely separated in a substance that is spoken of as gelatinous or edematous and in which fibrils are made out with some difficulty, and with certainty only after special neuroglia stains have been used.

Histologically, the structure of intradural tumors has given rise to considerable discussion. Byers states that "such tumors do not correspond with any special type of growth, but there is constantly present in the same specimen several phases of developing connective tissue." He has drawn an analogy between these changes and the changes occurring in elephantiasis due to primary obstruction of the lymph flow and uses the term "fibromatosis" to define such growths. He further states that there is essentially an over-

Fig. 3.—Photomicrograph showing general structure of the tumor. 16 mm. objective.

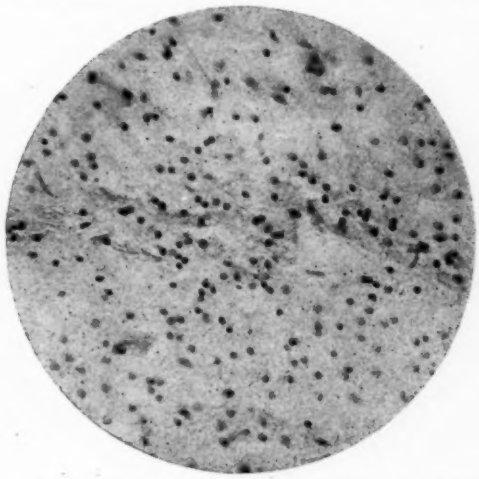

Fig. 4.—Photomicrograph illustrating the two types of glia cells with the fibrillar network. 4 mm. objective.

growth of connective tissue, which is protean in character, and that the feature described as myxomatous is in reality a simple edema due to elephantiasis. Ewing, in discussing two cases examined by himself and which he designates "neurofibroma of the optic nerve," states that they "consist of numerous small cells of the type of the glia cell, which lie in compact groups or singly in a mucous matrix." Hudson suggests the term "degenerative gliomatosis," implying a generalized overgrowth of neuroglial tissue of infiltrating character, dependent on some degenerative change of unknown etiology.

Again, the exact origin of the cells composing these tumors, whether epiblastic or mesoblastic, has also caused more or less discussion. According to Prentiss, "the embryologic derivation of such tissue is from cells of the neural type, which divide by mitosis and give rise to ependymal cells of the ependymal zone and to indifferent cells of the mantle layer; from the latter cells spongioblasts and neuroblasts are formed. The spongioblasts are transformed into neuroglia cells and fibers which form the supporting tissue of the nervous system, while the neuroblasts of the primitive cells, by developing cell processes, are converted into true neurons." With this view Mallory coincides, describing a "glioblastoma as a tumor of epiblastic origin in which the cells tend to differentiate into neuroglia." Hatai, on the other hand, has proven with some conclusiveness that a certain portion of the neuroglial cells are derived from the mesoblastic tissue which enters the nervous system about the blood vessels and that the neuroglia cells, with larger nuclei and less abundant fibrils, are of true mesoblastic origin.

From this brief discussion of the more general features of such cases, it may be seen that primary intradural tumors of the optic nerve are worthy of record not alone for their rarity, but also for their clinical interest and because they represent rather complex histopathologic features. The following case is therefore reported because

of the definite interest that obtains in this subject.

CASE REPORT.—A boy, age 10, white, had been brought to a physician because of a gradual loss of sight of the right eye. There had been no unusual disease of the part and no history of previous injury to the eye or cranium. At this time there was no exophthalmus. The boy had had the usual diseases of childhood; otherwise the history is negative. Seven and a half months later he came under the observation of an ophthalmologist. At this time exophthalmus was pronounced, the eye being forced directly forward; blindness was complete. Immediate surgical removal of the eye was advised and consented to by the parents.

Gross Examination. The tumor consists of a mass 3 x 2.5 cm., whose closest proximity to the globe is 8 mm. The tumor is somewhat irregular and shows distinct nodules on its surface. It is intimately surrounded by a rather dense fibrous capsule, which undoubtedly is the dural sheath. Upon section, the tissue is of a grayish color, which in some areas has a reddish tinge. It varies in consistency in different portions, some areas being dense, others softer, altho in no portion could it be described as edematous or gelatinous. The optic nerve, at its entrance into the eye ball, is normal in appearance and measures 3 mm. in diameter. At a point some 6 mm. from the globe the nerve is slightly constricted and beyond this point becomes lost in the anterior border of the tumor mass.

Microscopic examination shows that the tumor consists of a loose feltwork of fibrillar tissue, in which are scattered numerous small, deeply stained nuclei, which show a rather definite tendency to group themselves. The cytoplasm of these cells is scanty and, in many instances, cannot be distinguished. In some areas pale staining, round or oval nuclei are seen scattered about among the more typical glia cells. These cells are considered as belonging to the second group of glia cells mentioned by Hatai. Extending thru the mass are strands of coarse fibrous tissue, which subdivide the tumor into irregular areas. The blood vessels are numerous and pass directly thru the substance of the tumor, being enclosed by a connective tissue sheath, which is intimately surrounded by the fibrillar material. In certain areas no fibrils can be distinguished, the substance appearing more or less homogeneous. In this homogeneous matrix are spaces, of irregular size, resembling spaces in which fluid had accumulated, and giving the impression that the tissue had been more or less edematous in character.

The sections of the tumor were stained with hematoxylin-eosin, Mallory's phosphotungstic acid hematoxylin, Van Giesen's alum-hematoxylin, and Pal-Weigert stains. The Pal-Weigert stain was not successful, due to improper fixing of the tissues before reaching the laboratory. The phosphotungstic acid hematoxlin, however, showed distinctly the neuroglia fibrils, while the hematoxylin-eosin and hematoxylin-Van Gieson stains permit nicely the demonstration of the general structure of the tumor.

CONCLUSION.—From a perusal of the literature and the careful study of the tumor presented in this paper, it appears to the writers that the growth here recorded should be classed as a true tumor and that the terms "degenerative" and "fibrosis" are not adequate to explain its existence.

We wish to acknowledge our indebtedness to Dr. R. L. Barnes for the specimen and to Dr. R. Blee Smith for the clinical history of the case.

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TONOMETRY AND THE PREVENTION OF GLAUCOMA

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By use of his tonometer in a large proportion of his cases the writer has discovered many instances of slight increase of intraocular pressure above what is usually regarded as normal; and in many instances the patient has experienced relief from the use of miotics. A series of illustrative cases is given. The results of manometric tests comparing the Brown tonometer with other such instruments is also reported.

At the 1919 meeting of the American Medical Association Dr. John E. Weeks[1] read a very valuable paper on Personal Observations Regarding the Treatment of Glaucoma. Had Weeks published the important facts stated in his paper when his book on the eye was published, and before my papers were published on the concavity of the disc and the necessity of field taking in practically all refraction cases, he would have saved me and possibly many others much anxious and painful groping in the dark. Cases in his words "in which the tension is at or near the upper limit of normal, in which the anterior chamber is shallow, and in which there is even slight cupping of the whole or a part of the disc" will be found to be astonishingly numerous when we properly examine our cases.

But what is "the upper limit of normal?" Weeks says 25 mm. of mercury as determined by the Schiötz tonometer. McLean[2] says: "With this (McLean) tonometer the lower limit of normal intraocular pressure is to be considered as 22, while I have not found a normal eye registering above 40. I have placed the upper limit at that figure; because I have found eyes registering 40 in which there were no symptoms, subjectively or objectively, of glaucoma. * * * I have found a few eyes that registered 36 with the McLean tonometer and 22 with the Schiotz in which symptoms of glaucoma were present."

Priestley Smith's estimate of 25 mm. as the upper limit of normal, accepted by Weeks, seemed to me to be reasonably conservative, but when during my investigation of tonometers I found that a considerable number of cases registering 25 could be lowered by the use of miotics, and that some cases presenting such symptoms of glaucoma as shallow anterior chambers, more or less cupping of discs, contracted fields and enlarged blind spots, gave much lower readings, I became very suspicious of all such standards. Since the completion of my tonometer with a foot-plate of six mm. diameter (American Journal of Ophthalmology, Jan., 1920, p. 48) I have tested the intraocular tension of practically all my eye patients coming for refraction. The results have been surprising. I may say that there are very few children in my clientele.

The examination with the tonometer is made as a matter of course when any condition of fundus or field renders such examination desirable; and, strange as that may seem to some ophthalmologists, nearly all my cases furnish sufficient justification for the inconvenience of such an examination. Since discarding alcohol or sulphuric ether sterilization, and uniformly heating the foot-plate and plunger above a gas flame or preferably in the Bunsen gas jet, there have been no unpleasant results. Three drops of 1% holocain at five minute intervals will render nearly all corneas insensitive. A single drop of eserin solution is instilled after the test.

The patient lies on his back, is urged to relax as much as possible and fixes his eyes on a black spot directly over his head on the ceiling. The tonometer held lightly between the thumb and two fingers, by the *one armed handle*, is applied directly over the center of the cornea; the handle depressed till the weight of the instrument rests upon the cornea, and the reading made. If the patient's muscles are tense, or the physician's hand unsteady or the patient moves the eye, or the instrument is not vertical, there will be oscillations

of the needle and unsatisfactory readings. If used with reasonable care and skill I have found the readings more satisfactory and reliable than with the standard instruments.

At the meeting of the Minnesota Academy of Ophthalmology and Oto-Laryngology, at which my tonometer was exhibited, Gradle made the criticism that the McLean and my instruments were attempts to make absolute readings in disregard of the standard established by Schiötz. He also remarked that not one woman in a hundred could look vertically, so that the tonometer would rest properly over the center of the cornea, which made two or three readings desirable. With a large foot-plate of the Schiötz and McLean tonometers the personal element of doctor and patient is much greater than with my instrument; the small plate of which is more easily placed over the pupil, and the more "absolute" reading is more reliable, because the importance of correspondence of the curves of the cornea and foot-plate is eliminated. I wish to give a few cases which seem to be typical of those which come to me.

Case 1. Charles I. B. 15, about 1. D. myopic astigmatism, small central cups of discs, tonometer: R. 25, L. 22 mm. Some weeks later 22-27.

Case 2. Mrs. G. 54, mother of eight living children, severe headache and twitching of eyes lately, wearing plus 2. and plus 2. segments for near, which give nearly normal vision. Corneas anesthetic, pupils small, anterior chambers shallow, eyes hurt on motion and tender to pressure, form and color fields moderately contracted, slight if any cupping of temporal discs, blind spots enlarged: 20 and 23.

Case 3. Mrs. B. 52, 10.D. myopic (Case 8 of my paper read in 1917 before the American Academy of O. & O.-L.) lately complained of difficulty in threading a needle, distant vision good and fields only moderately contracted, tonometer: 50-40. Twelve days later after use of eserin 1-1000, tonometer 25-23, some weeks later 20-20.

Case 4. Moses B. 30, Jewish laborer, chronic conjunctivitis, corneal nebulae, anterior chambers shallow, temporal cups of discs, fields contracted, blind spots enlarged, V. 20/200, only slightly improved with weak minus lenses, tension 23-25, some months later 17-20.

Case 5. H. C. E. 43, bookkeeper (when first seen two years before slight cupping of temporal discs), fields contracted, blind spots enlarged, slight general cupping of discs, V. 20/15 with—.25—.25c. 180°, tension 30-30. Seven months later right eye irritable and tender, V. normal, tension 40-25, discontinued attendance.

Case 6. A. McC. 60, attorney, with correction of low degree of compound myopic astigmatism V. 20/20. Corneas 10 mm. and anesthetic; fields and blind spots nearly normal, temporal discs deeply cupped; tension 25-32, one month later 32-32.

Case 7. H. M. 48, attorney, temporal discs cupped, blind spots slightly enlarged, form fields nearly normal, red mostly inside ten degree, V. 20/15 with +.75+.50 c. 90. Two years later pyorrhea and pain in eyes, vision and refraction as before, red fields inside five degrees, tension 40-40. Now willing to use a miotic. Eserin 1-2000 causes pain, 1-6,000 used with comfort. Jan. 1, 1920, thirty-five days later, tension 25-33, 18th, 20-30, Feb. 5th, 25-28, April 1, 10-9, later some pain in eyes, tension 24-20, with McLean tonometer 14-14.

Case 8. W. M. 61, farmer, brother of Case 7, almost a duplicate including fields, tension 30-30. Did not return.

Case 9. C. D. S. 45, school principal, has had for some years serious nervous and digestive troubles and has had an immense amount of treatment by internists, specialists and dentists, including those of a world famous clinic where he was told that he was a nervous wreck. He now declares that my removal of his adenoids and tonsils, and treatment of his paranasal sinsuses, were the only tangible benefit he can recognize from all of it. I had ordered glasses for him years before, and as no complaint was made of the eyes I had later made no investigation of them. To my great chagrin I found, when he came with his child for an operation, that he was 45 years of age and had

worn no glasses for some years. V. with +0.50 c. 90° was =20/20, exophoria 8½°, at 13″ 17°; corneas anesthetic, chambers shallow, temporal discs deeply cupped and the vessels undermined; the right blind spot slightly, and the left greatly enlarged, form fields slightly and the color fields greatly contracted, tension 22-25. He was given a 3° prism correction in each distance lens, and in each reading segment, also one drop of 1-6000 solution of eserin at bed time. Six weeks later the tonometer readings were 15-22.

Case 10. E. F. B. 28, writer, has for some years worn 6° prism correction of his exophoria (1½° at 20′ and 20° at 13″) in each reading lens, 1 D. less than his full correction:

R. —1.75—2.25 c. axis 160°, V. 20/20.
L. —4.50—4. c. axis 180°, V. 20/20.

Having discarded his reading glasses for some months he had headaches. There is a small central cup of right optic disc, larger temporal concavity of the left disc. Form fields nearly normal, color fields moderately contracted, right blind spot greatly enlarged, the left only slightly, tension 28-28. After an operation for hernia and chronic appendicitis, and using his proper prism reading correction for three weeks, tension was 10-18.

Case 11. Laura S. 19, telephone operator, has had severe headaches, has a moderate compound hyperopic astigmatism which has been fairly well corrected. V. 20/15 and 20/20. Right hyperphoria 1°, exophoria 4°, abduction 11, torsion negative, excessive outward rotation of right and inward of left (60°), tension 43-38. Eserin 1-6000 soon reduced tension to 28-32. Discontinued attendance because of advice to operate on muscles.

Case 12. Mary B. 13, Jewish, meibomian inflammation of lids, following use of homatropia, tension 50 in each eye, after 16 days use of eserin 1-2000 tension was 32, with Gradle tonometer 20.

Case 13. Marion N. 16, student, headaches for years, vision blurred all her life. Under homatropia +1.25 c. axis 90°, V. 20/20; temporal discs cupped, fields contracted, tension 45-40. Under eserin 1-1000, tension twelve days later was 50-50, the following day under more intensive use of miotic 35-30, eight days later 48-43 and with McLean tonometer 37-35. She had a frontal sinuitis improving under treatment and diseased tonsils. One week after removal of adenoids tension was 25-20.

Case 14. A. B. 37, umbrella mender, father of case 12, incapacitated for work several days at a time, past five or six years, because of headaches and dizziness. Treated at University hospital and other free dispensaries, also a world famous clinic, in vain. None of the doctors found trouble with the eyes. Vision with +.25 c. axis 180° =20/30 and 20/40. L. H. 1°, esoph, 1°, 13″ Ex. 13°. Temporal discs cupped, fields much contracted especially the left, blind spots somewhat enlarged, rather unmanageable and the tonometric readings unsatisfactory but tension seems plus. The following day reported that the first drop of eserin 1-6000 made the eyes feel better, and the left less tender, tension 38-39. Eserin 1-1000 soon brought tension to 28-30. Very little headache or dizziness since wearing refraction correction, with vertical prism correction.

Case 15. Mrs. Minna W. 57, no complaint except of need of reading glasses. V. with weak compound convex lenses 20/15 and 20/20. Temporal discs cupped, blind spots much enlarged, fields greatly contracted, tension with the McLean tonometer 29-24. Two weeks later following the use of eserin 1-12000 McLean 18-22, Brown 32-35.

Case 16. A. P. A. 28, student, severe headaches. V. 20/20 with —.75 cyl. L. H. 2°, Exoph. 8°, fields contracted, blind spots enlarged, tension 40, after two months use of eserin 1-12000 tension 25 in each eye.

Case 17. N. O. 22, student, chronic conjunctivitis, V. 20/20 with weak concave lenses; fields and blind spots defective, temporal discs cupped, tension 40-40. With frequent use of eserin 1-2000 eyes felt better but tension remained mostly above 30 till a 1-1000 solution brought it down to 23-25.

Case 18. W. C. 39, retinitis pigmentosa, vision 10/200 and 20/200, not im-

proved, tension 47-34. After use of eserin 1-1000 for six days tension was 28-30.

Case 19. Miss M. A. W. 51, vision 20/70 and 20/200, not improved, anterior chambers shallow, marked retinitis pigmentosa, vessels narrowed and optic discs slightly cupped, form fields inside five degrees, tension 48-52. Visited Hickson's faith cure meetings. After four days use of eserin vision 20/50 and 20/70, tension 25-27. Still later accepted a weak convex correction with vision 20/50, tension 50-50, with McLean 31-31. After another two weeks corrected vision +20/40 and tension 35-35. It is an interesting coincidence that the lowest tonometric readings were shortly after the attendance at the faith cure meetings.

Case 20. A. P. 52, shoemaker, has had weak eyes all his life, pain over his eyes, especially the past week before consulting me on April 26th. Wears from optometrist +2. spheres and +2.75 reading segments. Vision 20/20 with R. +2.75+.75 c. axis 180°, L. +2.75+.25 c. axis 180°.

Corneas 10 mm. anesthetic, anterior chambers shallow, moderate general cupping of discs, blind spots slightly enlarged, fields slightly contracted for white, more for red, tension by palpation questionable, by tonometer 35-35. After four days use of correcting lenses and eserin 1-2000 tension is 30-27.

These nineteen out of more than one hundred and twenty-five cases, carefully examined since the completion of my tonometer last September, are hardly more pronounced than many others of the series, not one of which but has shown more or less of the signs of chronic glaucoma. Such an array of facts abundantly proves to me the truth of what I have more or less modestly suggested in previous papers: That chronic simple glaucoma is closely allied with a practically universal condition resulting from the failure of evolution to produce an eye capable of standing up under the stress of modern civilization. It is hardly supposable that my cases are entirely different from those going to other men. The natural inference is that most men fail to properly examine their cases. They trust to their text books and the leaders of the profession and recognize glaucoma when it is so far developed that only desperate remedies can possibly avail. When ophthalmologists examine every case of refraction as a possible case of glaucoma they will be just to themselves and to their patients; and can with better grace protest the work of opticians and optometrists.

Several hundred measurements of intraocular tension with my tonometer, in many instances in comparison with the Schiötz, Gradle-Schiötz and McLean instruments, have convinced me that my instrument is much more dependable and practical than the others; and that its registration while much higher in terms of mercurial pressure, is the only one that really represents such pressure in millimeters. I present the following evidence:

To minimize the possible error of the mercurial manometer with which I had standardized my tonometer, I constructed a water manometer as follows: A three-inch piece of brass tubing 15 mm. in diameter, closed at one end by being soldered to a metal base, was connected near the lower end with a short piece of 6 mm. tubing, to which a three way piece of glass was adjusted by rubber tubing. To one end of the three-way tube was connected a glass tube five feet in length, and pinned to a wooden support. To the other was connected a hard rubber cock to which a large hollow needle could be connected by rubber tubing. Two thicknesses of rubber dam attached securely and water tight to the upper end of the larger brass tube formed an artificial cornea. The upright was marked of course in millimeters multiplied by 11 1/9. For convenient and safe demonstration I have used rubber tubing in place of the glass, but am sure the glass forms a more accurate instrument.

On April 17 Dr. Charles Nelson Spratt invited me to Eitel hospital to try out my tonometer and manometer on a blind glaucomatous eye which he

was to enucleate. Tension before enucleation was 65 (McLean). Five minutes after removal of the eye tension by my tonometer was 15. Fifteen minutes later the vitreous chamber was pierced by a needle of about 1.5 mm. which was connected with the manometer. The following measurements were made: (Dr. S. using the tonometers.)

1. Comparison of artificial and enucleated eyes:

Water at 30	Artificial Eye	Enucleated Eye
McLean tonometer	16 and 15	19 and 20
Brown tonometer	34 and 40	30 and 30

2. Comparison of readings of McLean and Brown on enucleated eye:

McLean	Height of Water Column	Brown
27	40 mm. hg. 11 1/9	40
26	42	27
29	35	29
22	32	35
20	30	30
30	27	35
25	25	25

The following are readings based on the artificial cornea; from the Brown in comparison with the other tonometers:

Water	McLean	Gradle	Schiötz	Brown
80	31	24		78
70	26	26	28	70
60	28	24	25.5	65
50	19	18	25.5	62
40	18	17	22	35
35	17	9	20	30
30	16	9	19	25
25	13	4		25
20	10		17	20
15	—10			15
10			13	10

A few comparative measurements of intraocular tension:

	McLean	Gradle	Brown
Mrs. A.	35-38		45-45
Mr. H.	37-37	30-30*	50-40
Mrs. S.	26-26	24-20†	30-32
Mrs. W.	23-22	11-13	40-38
Mr. W.	22-27	13-17	32-32
Mrs. D.	26-26		38-38
Mrs. L.	26-26		36-36
Mrs. S.	26-24		30-33
Mrs. S.	21-22	17-17	40-40
Mr. N.	27-26		35-36
Miss W.	31-31		50-50
Mrs. McL.	20-22		30-30

*Day before 39-37.
†Two weeks before 50-50.

With thoroly anesthetized corneas, the patient looking at such a point as will bring the axis of the tested eye vertical, and the Brown tonometer applied with reasonable skill and held long enough to secure an accurate minimum, the readings will be almost as dependable as the measurement of a board with the carpenter's rule. That statement is true of a considerable number of cases, while in others there may be some oscillations of the needle and a disposition to make too high readings.

ETIOLOGY OF GLAUCOMA.

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Widely differing ocular lesions are known to be followed by glaucoma. But how, if in any way, they help to cause the disease is often obscure. This paper, reviewing its subject somewhat from the theoretic standpoint, attempts to determine the relation of these different conditions to the disease.

To the solution of this problem nothing new need be brought, nor is there herein anything novel propounded. The difficulty has been that we have not been able to see the forest on account of the trees. In other words—the details have clouded the main issue. It is not new knowledge that is needed, the mass of this is already overwhelming; but what is needed is that known facts should be correlated, coordinated, analyzed and their proper place as-

signed to their causal relationship. I trust that whatever may appear as dogmatic in this essay will be pardoned; but its restricted length will not permit of discussion of the reasons for such assertions.

Here is submitted for consideration the thesis; First: That glaucoma is not a disease but an expression of some systemic disorder. Second: That the glaucomatous condition is due to an imbalance between the inflow and outgo of the intraocular fluids, and that this imbalance is a disturbance of osmotic pressure from a proportional alteration between the colloids and crystalloids in the blood, lymph or aqueous. Third: That such alteration is brought about by chemic, toxic or biochemic changes in these fluids. Fourth: That the causes usually given for glaucoma; viz: old age, arteriosclerosis, macrolentis, microcornea, fibrosis of the pectinate ligament, etc., are not prime causal factors but are when such exist, predisposing or contributing only.

The foregoing applies to every type of glaucoma, excepting only traumatic, postoperative and such localized infections as invade and block up the channels of exit of the ocular fluids; intraocular hemorrhages and neoplasms come under this heading. Buphthalmos is purely an anatomic anomaly; but even here who may say whether or no the same causes which are operative later in life may not have been so in utero. The emotional type, while probably a vasomotor disturbance, has a causal factor as expressed by the disturbance which this induces in the colloidal balance of the dissolved protein in the blood plasma. If the sympathetic nervous system plays any causal role whatever in glaucoma it does so only as this is a part of the general toxemic condition.

The profession is of one opinion regarding the one essential fact of the glaucomatous condition—viz.: that the high tension is an imbalance between the inflow and outflow of the ocular fluids, and that all the symptoms which make up the clinical picture are consequent therefrom. This is self-evident but from this point of agreement there begins a divergence of opinion as to what brings about this altered interchange of fluids in the eye. Let us take up one by one, the causes usually given for an increased ocular tension and see how the arguments for these balance against the contentions embodied in this thesis. In so doing anatomic facts relative to the ocular structures and pertinent to this inquiry will be considered.

First. *Old age.* This is too inconsequential to be considered seriously. Senility might be, but even of the senile how comparatively few have glaucoma. The law of probability would rule out this cause except as contributory, and only then is it so when the degenerative changes which have led up to the senile condition are the results of such toxic or autotoxic influences as have altered the chemical or physical properties of the intraocular fluids and are still active.

Second: *Arteriosclerosis.* This demands a larger consideration. In the first place one is apt to assume, that with high systolic pressure there is an increased flow of blood to a part, and that increased pressure means arteriosclerosis. Neither of these assumptions are true. In fact, with an arteriosclerosis there is a lowered capillary tension and a consecutive venous stasis. This, per se, should cause a diminished lymph outflow unless the endothelial cells take on a hypersecretion. This is unlikely but what is most probable is that there is a chemical alteration in the lymph or in the aqueous from an altered secretion thru the ciliary glands. Only with a normal arterial wall is high systolic pressure a factor in increased ocular tension, and this is not a constant one for nature provides by the arrangement of the ocular circulatory system a governor to control an excessive supply of blood to the eye.

Barring transient vasomotor disturbances, an increased arterial pressure is due to toxic, infectious or autotoxic influences. A high systolic pressure is no criterion as to the condition of the arterial wall. There may be sclerosis with hyper—,normal or even hypoten-

sion, or marked hypertension with no sclerosis. Sclerotic hypertension is nature's protective measure and we have learned by sad experience that it is neither safe nor wise to attempt more than its proper regulation to the diastolic pressure. It is not the sclerotic process which concerns us in the consideration of the etiology of glaucoma, but rather the causes which have led up to the sclerosis. The same toxic influences which give rise to high blood pressure without sclerosis will induce the latter if the cause be long continued.

Before taking up the alleged *anatomic causes,* it is pertinent to mention one single fact which carries an incontrovertible argument against these. We may have and do have cases which exhibit all of the symptoms which have come about from increased intraocular tension, cupped disc, enlarged blind spot, and narrowed fields, but in which, as measured by the tonometer, no increase in tension is present. This means that whatever cause may have been present is not now active. An anatomic anomaly does not admit of variations but must needs be a constant condition. Another argument against this lies in the amelioration of the symptoms of acute glaucoma by a thoro flushing of the bowels and how the removal of septic foci, notably of the teeth, tonsils, and the nasal passages lower the tension and enlarge the fields of the chronic type. Such treatment could by no possibility alter anatomic conditions.

To attribute glaucoma to *fibrosis of the pectinate ligament* seems to rest on a very slender foundation. Fibrosis is an invariable sequel to advancing years, but age alone does not bring on glaucoma. Furthermore, even should this be found in many glaucomatous eyes, what is to determine if this be a primary causal influence or is a result and a secondary condition from the disease. The spaces within the pectinate ligament are lined by an extension of the endothelial cells which cover the posterior surface of the cornea and its function is presumably that of other dialysing membranes. To attribute to it any mechanical function in the filling or empting of Schlemm's canal would rest upon which of the two theories of accommodation we accept, and in either event would be slight indeed.

Macrolentis is another of the anatomic causes given. If the lens enlarges in its polar diameter its only effect would be to push the pupillary margin of the iris forward; if in the equatorial, the result would be a slackening of the zonula, the normal tonicity of the ciliary muscle would then increase rather than decrease the filtration spaces. Only when the lens comes forward as a whole would these be impinged upon, and in this event the lental size would be a minor factor only. All lenses grow larger with age, but it needs the change of senility to make this cause operative; and then only is it so when such changes alter the osmotic properties of the intraocular fluids.

It is difficult to understand how *microcornea,*—a rare condition per se—can enter into the causation at all, unless it be a concomitant of microphthalmia—in this event it would be classified with juvenile glaucoma under the heading of congential deficiencies. There can be no shadow of a doubt that anatomic changes occur in this disease, that the closing of the channels of outflow goes without saying but these are consequences not causes.

To get a clear concept of the pathologic changes in this disease we should hold in mind the scheme of the normal circulation in the eye, and the function of its various structures. The fluids of the eye, no matter what their ultimate destination or function may be, are brought thereunto by the arteries; these dividing up into capillaries and uniting again as veins form a simple and continuous circulatory system. Once in the eye there begins a process which takes the circulation out of the domain of mechanics, and transfers it to the biochemic and the mysterious realm of molecular pressure. Part of the confusion relative to the increase of intraocular tension comes about from the failure to keep clear in the mind the nature and function of the various ocular structures and of the circulatory fluids.

Of the former the only one that enters here at all is the *vitreous.* This struc-

ture is, in common with other cellular elements the outgrowth from embryonic cells and fulfills a definite purpose thruout life. It has nothing to do with nutrition or secretion and its purpose is purely optical in that it forms a spheric transparent medium, and while it determines the shape of the globe, has nothing to do with its tension. It is mentioned here simply because of its bearing on the hydrophilic theory which will be referred to later. Incidently it is here apposite to recall that the vitreous is not hydrophilic, the sclera is the only structure that exhibits this property.

There are three *circulating fluids* within the eye, blood, lymph and aqueous, and it must be clearly understood that these have separate and distinct functions and leave the eye thru separate channels. Only one of these, the blood, is in a continuous pathway. It can serve its function only in one way and that is that its nutrient content, either cellular or otherwise, shall pass through the arterial walls. The fluids, the lymph bearing the protein elements and the aqueous holding the crystalloids in solution enter open spaces and having no direct connection with the channels of outflow, it follows that they must leave the eye either by direct pressure filtration or by osmotic action. The lymph has nothing to do with the form or resiliency of the globe, its function is purely nutritive, the aqueous alone governs the tension. This is the one fundamental fact to be held clearly in mind throughout this discussion.

If *pressure filtration* was the active method whereby fluids left the eye, the law of mechanics would demand that there would be membranes permeable to such fluids. But such membranes which line or delimit the emergent channels are covered by epi— or endothelia. Their functions are known as either selective as to nutrient outgoing material or osmotic as to the inflow into their respective channels. In the eye these membranes are semipermeable,—hence, dissolved substances as well as the solvent can pass thru. In the eye it is altogether unlikely that pure pressure filtration plays more than a subsidiary role, or that physical pressure is the main factor in the maintenance of the interchange of the intraocular fluids. The physical pressure in the normal eye is practically equal in the vitreous and the aqueous chambers, certainly there is not enough difference to permit fluids to pass from one to the other by mechanical force alone.

It follows therefore that the flow from vitreous to aqueous chamber comes not from a vis a tergo, but that the circulation and incidently the volume of the aqueous fluid depends not only upon physical but *molecular pressure*. This is a silent but mighty force and can work against gravity or physical pressure. It is equal to the gaseous pressure which a unit of dissolved substance will exert when in a state of gas, at the same temperature and occupying the same volume as the unit of solution. Osmosis depends upon differences in concentration of two solutions, like and unlike, when separated by a semipermeable membrane, and applies only to true solutions. Typical colloids do not make these, and altho proteins suspended in the blood plasma act like a true solution and exert osmotic pressure it becomes a matter of conjecture whether or not this property is lost when these pass out into the aqueous. It is probable that they do and that they go out of suspension or solution—note the turbid aqueous occasionally seen in cases of glaucoma. In any event whatever increases colloids or decreases crystalloids interferes with osmosis, impedes the aqueous outflow and gives rise to increased intraocular tension. It can be that an altered balance between these in the blood plasma can increase the aqueous inflow, and so give rise to the same condition. Notably this may be so in a high chlorid content of the blood; but this comes also under the laws of osmosis and bears upon the contentions that are held in this thesis.

A brief resumé of the *hydrophilic theory*, which assumes an acidosis, is appropriate in this place. In 1917 I found in a consecutive series of cases of glaucoma marked *acetonuria*. The larger part of these were of the acute type. Dr. Casey Wood, in reply to my letter of inquiry said, "I am quite sure that there is nothing in the literature that involves the

proposition that acetonuria is responsible for, or is a constant accompaniment of the various forms of glaucoma. That systemic alterations have to do with the origin and onset of increased intraocular tension is by no means new. That hypothesis crops up every few years and is then forgotten. I certainly think that if you can establish the contention that acetonutia is a constant concomitant of the essentials of the disease we call glaucoma, it will be real addition to our knowledge of the subject." And so it would have been had it been so found but the next series of an equal number of cases show no acetonuria whatever. The only conclusions that I could draw were that acetonuria was an occasional but not constant accompaniment of glaucoma, was not causal nor even contributory. It is also well known that diabetics in whom acetonuria is so frequently found rarely have glaucoma. I did not know at that time that an acidosis need not necessarily be expressed as an acetonuria, but would show as a low CO_2 capacity in the blood. It is probable, however, in this protean malady, the basic causes of which lie in metabolic changes, that an acetonuria as an expression of an intestinal toxemia may be a part of the pathogeny, not essential or constant but which brings an occasional associate element to interefere with osmosis.

In 1890 Kneis advanced the theory of an endogenous *specific glaucoma toxin* but left this as a glittering generality without attempting to explain its origin. Hertel has shown that in glaucoma the albumin content of the blood was below normal as was also the osmotic concentration. In 1916 von Hippel testing his glaucoma cases found such serologic alterations that he thought these suggested a disturbance of the endocrin glands as causative factors. The past four years have taught us much about these little organs, and we have learned that they are the regulators and not the initiators of metabolic action.

An excess of epinephrin in the blood of glaucoma cases need not be looked upon as a causal influence, but rather as consecutive to or associate with an imbalanced endocrin supply from the other glands of this group. Dr. Hans Barkan mentions a case of angioneurotic edema in the course of which glaucoma supervened, and in which the ocular tension returned to normal on the cessation of the attack. Maynard reports twenty cases during a wave of epidemic dropsy. These theories are mentioned because they carry the basic idea that disturbance of metabolism is the one factor common to them all. Whether we view this as an anaphylactic phenomenon, as a modified colloidal reaction, as the expression of a toxic condition, or as a chlorid retention does not matter; the one essential fact that stands out is that they all exhibit one common effect—the rise in ocular tension, and as I have attempted to show this can come about only by an interference with osmotic action.

The researches in chemistry, physics and biology of the past few years have given us a new concept of the vital phenomena. Verworn expresses this tersely in saying, "Life is nothing more than a reaction of the colloids." The normal balance between these and the crystalloids is maintained by normal metabolism. Whatever alters this interferes with the multiform biochemic processes going on in the body. Only Omniscience can understand or could give the initial impulse which starts these processes; but once started, their continuance is physicochemical and we may safely apply their laws to a better understanding.

It may be objected that the foregoing is largely theoretic. I admit it but it is not hypothetic. The supreme test of a theory is its applicability to known facts, and this will apply to every case of glaucoma, assuming that it is true (and the writer thinks it is), wherein may be found evidences to prove it. Disturbances of metabolism may start anywhere from the ingestion of food up to its final transformation or absorbtion by the cell, may be due to disorder in any organ or group of organs of associate function, either from endogenous or exogenous influences and such disturbances begin by perversion of secretion.

Altered metabolism leaves its evidence in the bodily fluids or in the excretions, and it is by the examination of these, serologic, biologic, chemic or micro-

scopic, that disorder may be determined. It is not enough that a single one alone should be tested, all should be subjected to a thoro search. For example: Metabolic changes show in the nitrogen imbalance, but the urea determination in the urine tells us nothing of value unless the nitrogen intake is calculated over a period of several days. An examination of the blood, however, will give us the evidence we are seeking. Likewise with the urine showing an average urea output there may be for this particular patient renal inadequacy, as shown by a high creatin blood content. An excess of indican in the urine may indicate an active suppurative process or an intestinal toxemia. The latter may be present without indicanuria, but the feces will surely indicate this by showing an excess of indol and skatol. An acidosis may give no evidences as expressed by an acetonuria. but its presence by a low carbon dioxid capacity in the blood. The urine may have a normal or even subnormal sodium chlorid percentage while the blood will show that there is a chlorid retention.

It is not probable that glaucoma is due to any specific metabolic disturbance, and much work will have to be done to segregate cases, into their respective causal groups; but the roads to the solution of this problem lie along the paths herein indicated. This paper is in a way preliminary to such investigations upon which to report later. The whole subject is a maze of perplexities. Our knowledge is sorely lacking in the biochemistry of our bodies, and lacking this our deductions from the chemical reactions of the body fluids may be erroneous. But there is the road and however much in darkness we may grope we have the sublime hope and an enduring faith of an ultimate emergence into the light.

A GLAUCOMA QUESTION.

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This paper discusses the division of glaucoma into congestive and noncongestive forms, and reports two illustrative cases that indicate they are one and the same disease. The difference between their varied clinical manifestations is thought to arise from variations in the power of the coats of the eye, particularly the lamina cribrosa, to compensate the increased tension, and in the activity of the causes which precipitate an attack. Read before the Illinois State Medical Society and published here thru courtesy of the Society and its Journal.

The tendency of observers of late years to separate the noncongestive type from the congestive types of glaucoma, has been attended with more or less success, largely due to the prevalent divergence of opinion as to the form of therapy to be applied in the former type—surgical or nonsurgical. This latter phase of the question, however, has no particular bearing on the motive of this paper. This tendency, I am inclined to think, is not due so much to the definite knowledge at hand that the noncongestive type is a distinct entity, as to our inability to explain this phenomenon upon the theories most favorable to the explanation of the congestive types of glaucoma.

Some observers have even gone so far as to take the definite stand that glaucoma simplex is an absorbtive form of optic neuritis, attended with cupping and a low grade uveitis.

This theory was most self-satisfying, it relieved one of so much thought, it permitted the acceptance and application of the prevalent theories that explained nearly every phase of the problem of glaucoma. But as time went on and those working in the larger clinics where an abundance of material is always present, were able to observe these cases from this angle, they found that it was not quite so self-explanatory, as it seemed originally, the result being the continued divergence of opinion as to the therapy best suited to the noncongestive type of glaucoma.

The observations to follow, extending over a period of years, and deductions resulting therefrom are based purely upon my own opinion. The theory which I wish to present is, I believe, original. I have discussed this problem from this angle with but two observers, for whose opinion I have the most profound respect. One of the gentlemen did not agree with me, the other was quite enthusiastic.

I am thoroly aware of the vast amount of experimental work accomplished, and the many fascinating theories propounded and recorded in the literature. I am thoroly cognizant of their value and appreciate, as we all do, their practical application. To this already voluminous collection I wish to present for your view a theory upon one phase of the question only, and this I am inclined to think, will, in a measure, enhance the other theories now prevalent and looked upon favorably.

In presenting this theory for your consideration I find myself approaching the subject with more or less timidity, this timidity I am inclined to think is largely due, not to its theoretical basis, per se, but to its very simplicity.

The questions then for your consideration are:

1. Are the congestive and noncongestive types of glaucoma one and the same disease?

2. If so, why do we have the congestive symptoms in one, and the absence of them in the other?

In answer to the first question I am willing at this time to believe that they are one and the same disease. Their difference in my opinion is but one of intensity of the precipitant and the compensatory response of the eye ball to that condition. I am sure we have all seen cases where the line of demarcation between the different types has been so vague that we would be willing to make a statement one day and reverse ourselves a few days hence. We have all seen cases where but one eye was involved. Again we have seen bilateral cases where in one eye a certain type prevailed, and in the other a different type existed. We have seen cases where the congestive type has been engrafted upon a noncongestive case. In short, we have all seen every intermediate variety, forming a continuous transition from the simple noncongestive type to the acute fulminating types.

In answer to the second question. I believe the absence or presence of congestive symptoms is largely dependent upon the anatomic development of the eyeball. By which I mean, we are all familiar with the following facts. That certain anatomic conditions predispose to glaucoma, e. g. hyperopia, small cornea, shallow anterior chamber, highly developed muscle of accommodation, and well developed ciliary processes, large lens, diminished circumlental space, etc., etc. The capsule of the eye ball consists of the cornea and sclera, which is more or less fixed, depending upon the age, the elasticity diminishing as age advances. The weakest point in this, we might say, fixed capsule, is the lamina cribrosa. This, we find, varies in thickness from 0.1 of mm. to 0.4 mm. At this point we find a total absence of the scleral tissue. Occasionally a few fibres of the choroid may be present. But it consists almost wholly of the fibres of the optic nerve and the lamina cribrosa. The lamina cribrosa represents less than one-half of the thickness of the sclera and we find this consists largely of yellow elastic tissue. (Collins and Mayou.) We have then an almost nonresistant capsule, with the exception of the lamina cribrosa, which varies in thickness, and is never more than one half that of the sclera, almost entirely composed of yellow elastic tissue.

Certain *physiologic changes* take place that are worth recalling.

The meshwork of the iris angle (ligamentum pectinatum) is a cellular structure at birth, which undergoes a progressive and physiologic fibrosis, with subsequent sclerosis, until finally it becomes a fibrous structure. The individual strands of this meshwork are more than two times as large at advanced age as at birth, as a result the alveoli of the meshwork become markedly reduced

in size. The spongy nature of this meshwork affords free access of aqueous to the venous sinus of Schlemm, thence by tributaries into the suprachoroidal space and anterior uveal venous system. Fuchs' iris crypts afford direct access of aqueous to the veins of the iris.

Pathologically we find early, a sclerosis of the ligamentum pectinatum and of the tissues to the inner side of Schlemm's canal. In acute glaucoma the ciliary body is more or less distended by a venous stasis and may at times almost obliterate the circumlental space, thus pushing forward the root of the iris and lens. In old chronic cases the root of the iris is adherent to the posterior surface of the cornea, blocking off entirely or almost entirely the drainage angle. The openings for the exit of the venae vorticosae are narrowed. The anterior ciliary vessels are usually enlarged. The aqueous is said to contain a greatly increased quantity of albuminoids and inorganic salts. This increase is said to be greater in the acute form. According to Tronsco the colloid nature of aqueous lessens its diffusibility and prevents its free passage into the lymph channels. The cupping of the disc, its different gradations, the dipping of the vessels, the arterial pulsation, the peripapillary pallor, etc., etc.

To me the cupping of the disc is the most interesting phase of the entire glaucoma question. If it is a fact, and one I think, we are all more or less agreed upon, that the depth of the cup is not in direct ratio to the intraocular pressure, then the basic principle of this hypothesis is fundamentally correct. In other words, the disc with the greatest cupping does not indicate the greatest intraocular pressure as seen in the socalled glaucoma simplex and buphthalmos. The disc with the least cupping is seen in the acute fulminating type. Between these two extremes we find every degree conceivable. This being accepted as fact, we can now go on to the next step.

Why this extreme cupping in one case with little or no congestive symptoms and the little or no cupping in the other case with the most pronounced congestive symptoms?

According to the volumetric theory, the normal intraocular pressure depends upon the volume of fluids within the eye ball. Any variation in the quantity gives rise to a change in the pressure. That is, if the balance maintained by inflow or production of fluids and the outflow or resorption is disturbed increased tension takes place. (Henderson.) We need not at this time go into the further details of this theory for the purpose of this paper.

The socalled circulatory theory which takes into consideration the hydrostatic pressure existing between the venous system and the intraocular pressure should be mentioned and remembered. This is largely based upon the fact that the outflow of fluids into the sinus is by diffusion and not by filtration. Further, that the physiologic thickening of the strands of the meshwork of the iris angle furnishes a mechanical obstruction between the anterior chamber and the venous sinus of Schlemm. Thus is maintained the balance of pressure between these two systems.

The Fischer theory, which is based upon the affinity of tissues for water, or the tissue colloids for water, should also be mentioned.

We have then as the most pronounced predisposing factor, the sclerosis of the meshwork of the iris angle and to a lesser degree probably many other factors.

The circulation is probably an important exciting factor, whatever the factor or factors may be that can or will produce a disturbed circulation. What conditions will produce an anatomic pathology or psychic disturbance is not material to this question. Again whether the aqueous as the result is in such state, by that I mean its viscosity, that diffusion thru the iris angle is impeded or impossible, is also not in point here.

The facts remain whatever the predisposing cause, or causes may be; whatever the circulatory factor or factors may be that can precipitate an attack; the resultant state, whether it be a mild or a violent attack of glaucoma, is entirely dependent upon the degree

of the predisposing and exciting factor or factors, and the compensatory ability of the eye to respond to the abnormal condition.

To simplify this statement, let us conceive of a case where the predisposing elements are present in a mild degree and the precipitating factor present to the same degree; glaucoma will result, but the attack may be so mild as to pass unobserved. As time goes on and if this delicate balance is not corrected, other attacks will result; and eventually sufficiently severe to produce symptoms recognized by the patient, when he will consult a physician.

Again we know that if the intraocular pressure should rise suddenly to a considerable height, congestive symptoms will result, as in the swelling of the lens in trauma. Again these symptoms are absent when the increase in tension is gradual and remains within narrow limits, as in intraocular tumor. I have seen a tumor occupying four fifths of the globe, and at no time was the pressure elevated. Again in buphthalmus we have the marked enlargement of the capsule, the deep ampullaform cupping entirely out of proportion to the pressure. Here we probably have an absence of the precipitating factor and a preponderant presence of the predisposing factor, the anatomic state. Again in ectasia of the cornea or sclera. Disease of these parts preceded the bulging, the intraocular pressure was greater than the external pressure and ectasia resulted at the point of least resistance. Again I have seen staphyloma of the sclera in the absence of a history of previous diseases as in the following case which is in point here.

Case 1. D. B. aet. 67, married, salesman. Above average intelligence. First came under my observation 10/28/15.

Family history—good.

Personal history—subject to dizzy spells which may come on suddenly and is at times compelled to support himself to keep from falling. Also has dizzy spells after close work. Difficult to read with present glasses.

Lost sight in right eye gradually. First noted failing vision about twenty years ago. Has never had any pain or redness of eyes worth mentioning.

Examination disclosed the following:

Right vision, *nil*, no perception or projection. Eye deviated outwards and appears prominent.

Cornea. Deep infiltration, luster absent. Epithelium roughened, but does not take the stain.

Sclera thin and bluish over entire equator. Has a large staphyloma over attachment of internal rectus, another staphyloma not quite so large over attachment of external rectus.

Tension, to finger about 3 plus.

Left, vision 20/80 glasses 20/33 minus 2. Dilitation with euphthalmin. Gave 1+1.00 20/25. Reading, Snellen 3.

Cornea, anterior chamber, iris negative. Lens, riders of incipient cataract.

Fundus, negative.

Tension, taken with Schiötz tonometer, three times.

R.—average 70. L.—22.

Urinalysis repeated, negative. Had passed insurance examination about two years previous.

12-14-15 Tension—again taken with tonometer.

R. average 70, L—18.

Transillumination of right for possible neoplasm neg. 1-16-17 Last seen. Right—Tension high + + + + Vision *nil*.

L. 20/40 Correction 20/33 minus 1—small central opacity developing in lens. Tension neg.

Repeated perimetry disclosed nothing in particular in left eye. The patient in this case has since passed away. I was unable to get this eye.

It was my opinion, in this case, that the scleral staphylomata were the result of the increased pressure. The probabilities are that the lamina cribrosa was thick, or had been forced back as far as possible and the sclera proper then became the point of least resistance and bulged at these points.

Another case in point to this subject is the following:

Case 2. C. B. aet. 56, married, harnessmaker.

First came under my observation 5/22/17.

Family and personal history good. Is at times subject to rheumatism and left side of face swells occasionally.

Eye history. For the past three years has noted that the vision in his left eye becomes blurred, sometimes so bad that he cannot see to do his work. There is some pain with these attacks, which come and go, but never severe. Eye becomes blood-shot and feels as if pressure was being applied.

Right eye. Vision, fingers at two feet on temporal side only for past two years. Central vision is entirely gone. He does not recall when this first started.

Tension. To finger normal.

Cornea. Anterior chamber negative.

Iris, dilated to 6 mm.

Ophthalmoscopic examination, typical glaucoma simplex, depth of cup about 3 diopters, fundus otherwise negative.

A few stationary cholesterin crystals were found in the vitreous.

Left eye, vision, 15/50, +.50 ⊃ +.50 C. 180°=15/33.

Tension to finger, questionable if elevated.

Cornea, anterior chamber, iris negative.

Ophthalmoscopic findings, media, negative. Many small fresh hemorrhages, both deep and superficial thruout retina. Arteries somewhat contracted. Veins dilated and tortuous. No cupping of disc recognized.

Repeated urinalysis disclosed, both hyalin and granular casts—undoubtedly the cause of the tortuousity of the vessels and the hemorrhages. These hemorrhages were eventually absorbed, with some improvement in vision, veins remained somewhat tortuous.

The disc now showed a possible cupping of one diopter.

Operation. Vision improved slightly. Tension normal. There has, however, since been a gradual decrease in vision. 2/3/20 R. Vision nil. Cupping now about 7 diopters, fundus otherwise negative.

Left. Vision with glasses about 15/50 with difficulty.

At no time has there been an elevation of tension since operation.

A summary of these two cases discloses some interesting points.

In case 1, we found an eye ball with a tension of 70, with marked ectasia of the sclera over the attachments of the muscles, which incidentally is the thinnest part of the sclera proper, with a complete absence of congestive symptoms over a period of twenty years. The other eye being absolutely normal with the exception of the incipient cataract.

In case 2, we have in the right eye a typical glaucoma simplex picture, with about seven diopters cupping. In the left eye a mild congestive type of glaucoma with barely perceptible cupping.

To Recapitulate: (1) The outer coat of the eye ball is not in all cases a nonelastic capsule. The lamina cribrosa varies in thickness from 0.1 mm. to 0.4 mm. (Salzmann states that it is impossible to accurately measure the thickness of the lamina cribrosa.) It is made up almost entirely of yellow elastic tissue, and is therefore the point of least resistance. Thus the degree of cupping is not dependant upon the intraocular pressure, but upon the thickness of the lamina cribrosa and the composition of its constituent elements.

(2) There is no positive line of demarcation between a glaucoma simplex and a very mild form of congestive glaucoma. The presence of the so-called lacunar or cavernous atrophy of Schnabel and others found in the optic nerve, which advocates of the glaucoma simplex entity put forth to prove their contention, is also seen in myopia. Stock found the same lacunae in eight cases of myopia. We are all more or less satisfied that advancing myopia is due to disease of the sclera. In other words, we again have the factor of the intraocular pressure greater than the resistance. The fact that the congestive type of glaucoma is never seen in myopia is most significant. Therefore is it not conceivable that these lacunae, which are first seen as tiny clear spaces in the lamina cribrosa and in the optic nerve tissue and are thought to fuse and form larger cavernae, are the result of the pressure

with the eventual pressure atrophy. Schnabel contended that the cupping in all cases of glaucoma was so formed. The fact that the lamina cribrosa may almost entirely disappear, or may bridge across the cup like a cord or lie back against the optic nerve trunk is worthy of record.

SUMMARY:

(1) Noncongestive and congestive glaucoma is one and the same disease, the difference being only one of degree.

(2) The cupping is not in direct ratio to the pressure, but largely dependent upon the thickness of the lamina cribrosa and the nature of its component elements.

(3) The presence or absence of congestive symptoms is entirely dependent upon the congenital or pathologic anatomic state, and the degree of intensity of the precipitating factors.

(4) In glaucoma simplex the absence of congestive symptoms is entirely due to a very thin distensible lamina cribrosa, plus the very mild exciting factor or factors; the lamina cribrosa acting as a sort of compensatory valve to this mild transient precipitant.

NOTES, CASES AND INSTRUMENTS

BASAL CELLED EPITHELIOMA OF THE CONJUNCTIVA.

DAVID H. COOVER, M.D.

DENVER, COLORADO.

In the Ophthalmic Record of October, 1903, I reported a case of papilloma of the cornea affecting the right eye in a man 66 years old; which started from a cicatrix at the outer margin of cornea where a supposed pterygium had been removed. The growth grew very rapidly, until it projected over the margin of the lower eyelid and invaded the outer half of the cornea extending around on the lower and inner part of it, Fig. 1. It was pinkish in color; and had the cauliflower, raspberry appearance, made up of clusters of soft papillae. They were movable and surrounded by a loop of vessels from which they seemed to spring. It measured 10 mm. transversely by 13 mm. The growth was removed and examined by a pathologist, who reported it to be a papilloma of the cornea.

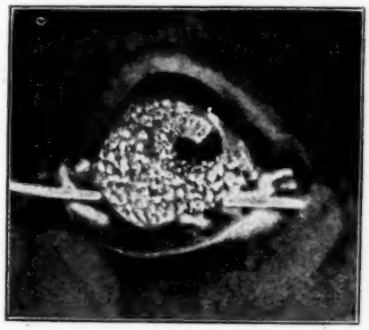

Fig. 1. Papilloma of Cornea Removed 1903. (Coover).

The eye showed no evidence of the papilloma returning until March, 1913, ten years afterward, when the patient

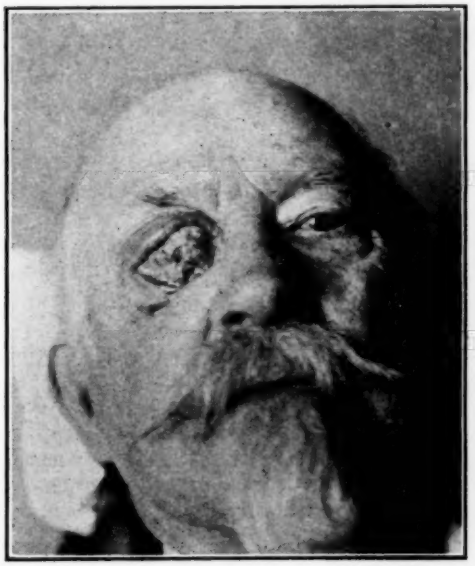

Fig. 2. Growth Recurrent as Basal Celled Epithelioma 1914. (Coover).

noticed it coming back. It grew very rapidly to the size as seen in Fig. 2, from a photograph taken when he again presented himself for treatment in August, 1914, eleven years after I had removed the first growth.

The mass had completely covered the cornea and ocular conjunctiva, projecting over the lower eyelid, pushing up the upper lid and filling the whole palpebral fissure; excepting for a small rim of healthy conjunctiva of 3 mm. in width, which extended around the upper and lower eyelids. There was no pain; some secretion and erosion due to exposure. The only discomfort he complained of was from light and dust, which caused him to wear colored glasses.

The growth had the same cauliflower or raspberry appearance as the first one, made up of small clusters of soft papillae. Each papilla was surrounded by a loop of vessels which bled freely when removed. The lids could not be closed on account of the growth projecting beyond them. The eye was removed and care was taken that no diseased tissue was left in the orbit.

The patient is still living and has had no recurrence of the growth.

The specimen was given to Dr. Phillip Hilkowitz for examination, who reports as follows:

Macroscopic appearance. The neoplasm, which is of a reddish-gray color, measures about 5 by 3 cm., and has a surface covered with cauliflower-like excrescences. On section a white surface is presented; the tissue is rather soft to the touch.

Microscopic appearance. Sections reveal irregular masses or islands of epithelial cells separated from each other by thin bands of connective tissue and growing in an atypical manner. The epithelial cells are of the basal cell variety. While most of them are active, a few show signs of degeneration or karyorhexis. Here and there are accumulations of colloid substance. In the center of the masses of epithelium are found cells which assume bizarre shapes.

Pathologic Diagnosis. — Basal celled epithelioma.

REPORT OF A CASE OF CRYPTOPHTHALMIA.

SAM N. KEY, M.D.

AUSTIN, TEXAS.

Cryptophthalmia is a rare condition. Turovsky claims that the case he reports in the Roussky Vrach, Volume XV, No. 15, is the fourteenth described in the literature. The case which I report, a twelve-year-old girl, disappeared from observation before I was able to complete my study of the case. Hense I am unable to state whether heredity was a factor, or give other

Fig. 1. Cryptophthalmia Patient Looking Down. (Key).

data which might be instructive in this condition.

On the right side, it will be seen from Figures 1 and 2, the skin of the brow is continuous over the orbit, the skin passing directly to the cheek without any differentiation into the lids. Palpation of the orbit revealed only a soft mass, with no indication of the presence of a globe. The eye brow on this side was present only at the very outer portion and blended with the hair of the scalp. There was a complete absence of light perception.

The left eye also presented an interesting condition. As will be seen from Figures 1 and 2, an eye was present on the left side. This was a microphthal-

mic eye, being possibly three-fourths of the normal size. The lower lid, tho correspondingly reduced in size, was normal in every respect. The upper lid, however, was imperfectly formed and adherent to the globe. From what should have been the free border of the upper lid, a thin, white film extended downwards, covering the upper three-fourths of the cornea. Figure 2 shows the cornea covered with this film, which is continuous with the skin of the upper lid. No cilia were present on the upper lid, but the eye brow was faintly developed. The lower quarter of the cornea was fair-

Fig. 2. Cryptophthalmia Patient Looking Forward. (Key).

ly clear, and thru it could be seen a blue iris. More than light perception was present in this eye, for movements of objects could be detected. Ocular movements were normal.

The only other abnormality present was a webbing of the fingers of both hands. The patient's behavior and general appearance were suggestive of a lowered mentality.

No operative procedure was contemplated on the cryptophthalmic eye, for in this condition operations have been uniformly unsuccessful. In the left eye the corneal involvment was so great that operative interference seemed inadvisable.

CANTHOTOMY.

FRANK A. MORRISON, M.D.

INDIANAPOLIS, IND.

In the last few years an unusual number of cases of trachoma with corneal ulcers and the usual complications have come under the care of the writer.

It seemed that the mechanical effect of the lid pressure had not been fully taken into account in the production or aggravation of many corneal diseases; and that treatment based upon this had been neglected. For some time canthotomy was a routine measure in all severe trachomas with contracted fissure, but with the publication of Dr. Wyler's experience new interest was aroused and the writer set out methodically to investigate several points, the result of which is given below.

Was lid pressure a potent factor in promoting corneal complications in trachoma, or unfavorably influencing ulcers of the cornea in general? Could such pressure increase the severity, or prolong the disease in the lids themselves? Was it possible to remove undue lid pressure by operation which would not entail a lasting disfigurement? With reference to the last it is only necessary to recall the miserable deformity following a "successful" canthotomy by the accepted method.

To all of the above questions the result of the investigations seemed to give an affirmative reply. As a recital of the particulars of the various experiments would prove wearisome only the results are given.

Having arrived at the conclusion that lid pressure is capable of producing effects outlined above the great practical question was that of relieving such pressure painlessly, safely and without deformity. I might add here, as a question might be raised as to whether or not pressure was certainly removed, that the sensation communicated to the fingers was not relied upon alone, but certain measuring instruments used which eliminated a source of error.

The methods of performing canthotomy varied with the conditions to be

met. In every case the operation was made under local anesthesia. A 4% solution of cocain dropped into the conjunctival sac, a few crystals of the drug pushed well into the outer commissure and a 1% procain-adrenalin solution infiltrated into the skin at the outer commissure.

In cases of corneal ulceration without trachoma the simplest method was employed. A broad cataract knife was passed from the canthus outward toward the temple, held flat-wise so as to split the skin into two layers. This splitting was increased by lateral movements of the knife until a flap one-half inch in length, measured from base to apex, and a quarter of an inch in width was formed. The edge of the knife then turned backward and all the deep underlying structures divided as it was withdrawn. A silk suture entered at the apex of the flap and passed into the conjunctiva, drawn taut, served to force the superficial layer of the skin into the grooves formed by the separated or retracted underlying structures.

In all cases of trachoma one of the succeeding operations were made. Two converging incisions were made, beginning one-half inch external to the canthus and converging toward the angle. At the base these incisions were one-third of an inch apart, and at the apex one-eighth of an inch. The cuts involved only the superficial layers of the skin. A cataract knife entered in the lower incision at the base, emerged through the upper, and by a gentle sawing motion the skin was split into two layers as the knife was carried toward the eye where it cut its way out. The flap now retracted showed the underlying deeper part of the skin, muscle and fascia. These were freely divided from apex to base by the scissors and the skin flap drawn by a suture placed in its apex and attached to the conjunctiva.

In old and neglected cases, especially those with contracted fissure, in addition to the suture above two others were placed; one attaching the skin of the lower lid to the conjunctiva and a similar one for the upper. These two sutures were identical with the lateral sutures placed in the generally accepted method of performing canthotomy. Sutures removed on the fourth day and the only dressing borated vaselin.

The large number of trachomas coming under observation permitted control observation, that is, both eyes being affected to the same degree one was operated upon and the other not, otherwise the treatment of both was the same.

Without exception the operated eye progressed so favorably, that the fellow eye was operated upon in like manner later, and generally at the urgent request of the patient.

TORIC TRIAL LENSES.

RALPH WALDO PLACE, M.D.

SOMERVILLE, MASS.

Whether toric or flat lenses are better for the individual can only be decided by testing with both.

It is a fact that some see as well and a very few see better with flat lenses than they do with torics. It is a great help to have the two kinds so that first one and then the other can be worn for a few minutes and the difference noticed.

Even with one of the scales for the purpose, it is not accurate to fit a patient by means of flat lenses and then try to figure the equivalent strength in torics.

I began this work with uncut lenses; but I found them unhandy to use.

Several months ago I had a complete set of trial lenses made in the six diopter curves. Since then I have used them in a large number of cases and I have found them to be entirely satisfactory.

SOCIETY PROCEEDINGS

Reports for this department should be sent at the earliest date practicable to Dr. Harry S. Gradle, 22 E. Washington St., Chicago, Illinois. These reports should present briefly the important scientific papers and discussions.

ROYAL SOCIETY OF MEDICINE. SECTION ON OPHTHALMOLOGY

June 9, 1920.

MR. W. T. HOLMES SPICER, Presiding.

Perithelioma of Lid.

MR. R. S. CHARSLEY exhibited a specimen which had been pronounced a perithelioma of the lid. The family practitioner had mistaken the tumor for an ordinary meibomian cyst, and had incised it. When the patient came to Mr. Charsley he removed the growth, and for two months thereafter the man remained in good health. The temporal bone then commenced to enlarge, and the patient noticed that his vigor was diminishing. Two months later still he developed weakness of the spine, and ultimately spinal curvature, probably due to tumor recurrence in the vertebrae. Death supervened six months after the tumor first became prominent. There had been no recurrence at the original site.

DISCUSSION. Mr. Treacher Collins' view was that the growth was alveolar sarcoma, while Mr. M. S. Mayou considered it was perithelioma.

Mr. Leslie Paton related a case of his own in which tho the endothelioma was apparently thoroly removed from the orbit, there was subsequent spread to a number of glands elsewhere, and death was immediately preceded by a large mediastinal growth, of the same histologic nature as the original one.

Neurofibromatosis.

MR. A. W. ORMOND exhibited a case of neurofibromatosis (von Recklinghausen's disease). There was extensive pigmentation over the body, and a number of soft tumors. The main complaint was of headache and failure of sight. His vision in each eye was 6/18, and he had optic atrophy following papilledema. The Wassermann test gave a negative result. The hands and feet were larger than normal, and the supraorbital ridges very prominent: in addition there was some kyphosis. The systolic blood pressure was 105 mm., the diastolic 80. Mr. Ormond thought the indication was some overaction of the pituitary body, probably following an affection of the fibrous tissue at the base of the brain. He exhibited skiagrams of the skull.

DISCUSSION. Mr. J. H. Fisher thought there had probably been some irritation of the pituitary gland, resulting in hypersecretion, and that this accounted for the acromegaly.

Cyst of Iris.

MR. W. H. MCMULLEN showed a case of cyst of the iris. There was in this case no history of injury for implantation of epithelium. The tension of the eye was normal, and the condition seemed to cause the child no inconvenience.

DISCUSSION. Mr. Fisher and Mr. Treacher Collins thought there might have been an unnoticed puncture, and Sir William Lister spoke of the careless habit in some women of sticking needles and pins into handy pillows or cushions, on which the baby might be placed. A puncture of the eye might not be noticed at the time, and it would probably quickly heal. This view was supported by Mr. Ormond.

Corneal Opacity.

THE PRESIDENT exhibited a patient with horse-shoe shaped opacities in the cornea. There was only one complaint, namely, of gradually diminishing vision during the last few years. Only a negative history was obtainable.

Ophthalmic Herpes.

MR. C. W. ROLL showed a child with herpes ophthalmicus. The attack occurred in February last, simultaneously with chicken pox, the eruption remaining on the brow. Part of the eruption

was along the course of the nasal nerve to the tip of the nose: the cornea also was involved. The association between herpes ophthalmicus and chicken pox had been frequently noted. He spoke of other recorded cases, as did the President and Mr. J. H. Fisher.

Punctate Keratitis.

Dr. Rayner D. Batten exhibited a patient with superficial punctate keratitis, of two years duration, which had been very resistant to various treatments.

The President spoke of a similar case in which treatment seemed hopeless: eventually the condition seemed to wear itself out.

Anomaly of Canthus.

Mr. W. H. McMullen's second case was one of congenital malformation in the outer canthus. The other extremities of the left lids were separated by a low pad or cushion of tissue covered with skin. The suggestion of an amniotic band and adhesions before the displacement, seemed to him a plausible one.

Discussion. Mr. Treacher Collins was reminded by this case of a class which was described in the "Ophthalmic Hospital Reports" by Sir George Berry. In the cases shown by that observer there was a symmetric flattening of the malar bones, leading to the impression that the patients were brothers. He thought the most reasonable explanation was that there was delayed closure of the cleft between the frontal-nasal plate and the superior maxillary plate at the outer canthus.

Horn of Lid.

Mr. W. L. Hine showed a patient with a malignant sebaceous horn, in which there was a large recurrence, and great benefit had so far accrued from a single (eight-hour) exposure to radium. The case was still under observation.

Exhibits.

Mr. T. C. Doyne showed a case of furrow keratitis, and Mr. Wallace exhibited some of the daylight glass which was due to the research at Cornell University. H. Dickinson.

SECTION ON OPHTHALMOLOGY AMERICAN MEDICAL ASSOCIATION.

April, 1920.

REPORT ON THE ULTRAVIOLET AND VISIBLE TRANSMISSION OF EYE PROTECTIVE GLASSES.

In June, 1913, the Council of Health and Public Instruction of the A. M. A. appointed a Committee on Conservation of Vision, of which Dr. Frank Allport, of Chicago, was made the Chairman. Shortly after this, a subcommittee on Hygiene of the Eye was formed for the purpose of determining some of the effects of artificial light upon the eye, and I was honored by being made its chairman, with full powers of appointment, organization and conduct. Realizing the necessity of obtaining the cooperation of investigators who were more or less familiar with the physics of optics and the practical problems of lighting, an invitation was extended to a number of well-known physicists and illuminating engineers to take part in the investigation. Drs. Edward Jackson and Wm. M. Sweet were the other ophthalmologic members of the committee. The committee, as finally constituted, was as follows:

Dr. Wm. Campbell Posey, Philadelphia, Pa.
Dr. Edward Jackson, Denver, Colo.
Dr. Wm. M. Sweet, Philadelphia, Pa.
Dr. C. P. Steinmetz, Schenectady, N. Y.
Dr. Louis Bell, Boston, Mass.
Dr. Chas. F. Scott, New Haven, Conn.
Dr. Percy W. Cobb, Mineola, N. Y.
Dr. H. E. Ives, Philadelphia, Pa.
Dr. E. L. Elliott, New York, N. Y.
Dr. A. W. Goodspeed, Philadelphia, Pa.
Dr. C. E. Ferree, Bryn Mawr, Pa.
Mr. J. Franklin Myer, Washington, D. C.
Mr. P. S. Millar, New York, N. Y.
Mr. George Ross Green, Philadelphia, Pa.
Mr. C. O. Bond, Philadelphia, Pa., Sec.

Among the subjects which fell under

the scope of this Committee, was to ascertain if possible the power certain lenses have of absorbing injurious radiant energy, so that oculists and others might have authentic and authoritative data upon which to base their prescriptions. Realizing that such information could only be obtained by those trained in physical research work, the Committee appealed to the National Bureau of Standards, requesting that it undertake the task of investigating the spectral transmission of the various glasses which are being commercially promoted in protecting the eye from harmful radiant energy. The Committee submitted nine samples of glass for investigation; to these the Bureau added seventy-three.

The report of the investigation of these eighty-two samples of eye protective glass, socalled, in regard to their transmission of ultraviolet and visible radiant energy, was issued by the Department of Commerce, Bureau of Standards, S. W. Stratton, Director, June 7, 1919, in pamphlet form, designated No. 119, under the title of "The Ultra-Violet and Visible Transmission of Eye-Protective Glasses," by K. S. Gibson and H. J. McNicholas, Assistant Physicists of the Bureau. [Sold only by the Supt. of Documents, Government Printing Office, Washington, D. C., price 10 cents.]

Part of the determinations were made in the physical laboratory at Cornell University and in their report the authors extend their thanks to Prof. E. L. Nichols of that institution for courtesies extended the Bureau in affording facilities to expedite this work, which would otherwise have been greatly delayed. The authors also acknowledge their indebtedness to Irwin G. Priest, who originally planned and initiated this investigation, but was obliged to lay it aside on account of other duties. Acknowledgement is also made to J. T. Filgate, who assisted in observing and computing.

The importance of this investigation cannot be overestimated, and every member of the Section is advised to secure a copy of the pamphlet for study and references. Owing to its length, it is impossible to submit the report in its entirety to the Section and only its most important conclusions will be transmitted.

In introducing their subject, the authors state:

"It is well known that ultraviolet radiant energy of certain wave lengths, such as occur in the quartz-mercury arc, the iron arc, and many other sources, is extremely injurious to the eye. Excessive brightness in the visible spectrum may also cause temporary or permanent injury; while the intense heat or infrared radiant energy coming from molten glass or metal is also considered by some as being dangerous to the eye.

This danger of injury from such sources undoubtedly depends on both the wave length and the intensity of the radiant energy, but in spite of the great amount of work which has been done on this subject quantitative data with few exceptions are not available. It is only recently that accurate data on the transmission of eyeprotective glasses have begun to be published. The following list comprises all the important previous publications which we have found giving data on this subject.

"In 1911 the Bureau published the spectral transmissions of a few glasses of well-known trade names as determined by P. G. Nutting at the Bureau[2].

"In 1914 Crookes[3] published the results of an investigation in which he made and tested over 300 specimens in the search for the ideal colorless or neutral glass which should absorb all the ultraviolet and infrared. Tho he failed to find this ideal glass, he did succeed in producing a colorless glass which absorbed much more of the ultraviolet than ordinary colorless glass, and a blue-green glass absorbing about 90 per cent of the radiant heat. In his paper he gives, for plates of each glass 2 mm. thick, the 'limit of transmission of ultraviolet,' the 'percentage of heat cut off,' the 'percentage of luminous rays transmitted,' and 'the color as registered on a Lovibond tintometer;' but no data are given as to the per

cent transmission at different wave lengths.

"About the same time Luckiesh[4] measured photographically the per cent transmission from 300 to 500 μμ of nine samples of eye protective glass —one colorless lead glass, three 'smoke' or neutral, one amethyst, two amber, one 'Euphos' and one 'Akopos' —without, however, giving the thickness. A number of spectrograms of these and other eye protective glasses are also given, showing approximately the limit of transmission in the ultraviolet, but again the thickness is usually not indicated. The total transmission factors for the visible are given.

"In a paper on colored glasses Gage[5] compares the colorless 'Crookes' glass with the 'Noviol' glass manufactured by the Corning Glass Works. Transmission curves and spectrograms, 400-720 μμ, of 'Noviol,' 'Noglare,' 'Noviweld,' heat-absorbing and railway-signal glasses are given.

"A paper by Martin[6] has appeared during the progress of this investigation which gives quantitative data for ultraviolet, visible and infrared transmission of various shades of neutral, 'Crookes' neutral and green shades, 'Fieuzal' and 'Hallauer' glasses. The thickness is given in all cases. He made use of the Hilger sector photometer to obtain his ultraviolet data.

"Coblentz and Emerson[7] have published considerable data on the infrared transmission of eye protective and other glasses. The samples studied included yellow-colored, 'Crookes' neutral and green glasses, various glasses for absorbing the infrared, such as gold-plated, blue-green (heat absorbing), greenish-brown, black and 'Noviweld' glasses, the thickness being given in all cases. They have also given the per cent transmission of these samples for the undispersed radiant energy from the gas-filled tungsten lamp, the quartz-mercury arc, and the magnetic arc.

"Only the last of these papers supplies extensive data such as are presented herewith for glasses at present on the American market. In some cases comparison of data in this paper with previous data will indicate the degree of agreement obtaining in the spectral transmissions of accidentally selected glasses bearing the same trade name."

Then follows a brief elementary discussion for those unfamiliar with Spectrophotometry, including an explanation of terms used in the paper; the illustration of method for computing the transmission for thicknesses different from that measured; instruments used and specimens studied.

The authors state:

"These specimens are all designated by their trade names. Some of them are of unknown origin, specimens which have been marketed for years under more or less well-recognized trade names. The data given show what may be obtained under one of these names, but, as there are usually so many different shades of the same kind of glass marketed under the single trade name, it can not be expected that duplicates can be obtained merely by ordering by name. However, most of the specimens, especially those of American manufacture, are designated by shade—that is, "A," "B," etc.—as well as by trade name or by number, and in this case it is expected that approximately duplicate samples can be obtained. If accurate reproduction is required, the designation should not be assumed as a sufficient specification; but the oculist or buyer, guided by the data given herewith, may now prescribe or order glasses of specified spectral transmissions, acceptance being subject to test.

The surfaces of these specimens were highly polished and with very few exceptions made plane and parallel to 0.01 mm. They are of a thickness ordinarily used in spectacle lenses. They have been labeled and filed at the Bureau for future reference. In table 1 is given a list of these glasses arranged alphabetically according to their trade names, together with the name of the company, the color, thickness, and other data which will be discussed later."

The results of the investigation were shown by curves in a series of figures

Table 1.—List of Specimens Studied.

Specimen, company's designation	Company	Color	Thickness in millimeters.	Instrument [a]				Total transmission factor
				H	L-B	K-M	M	
Akopos	King	Yellow-green	2.17	(*)	(*)	(*)	(*)	.79
Amber A	A. O. Co.	Yellow	2.13	(*)	...	...	...	0.36
Amber B	... do	... do	2.13	(*)	...	(*)	...	.57
Amber dark	W. & O.	... do	1.85	(*)	(*)	(*)	(*)	.555
Amber light	... do	... do	1.93	(*)	(*)	(*)	(*)	.805
Amethyst A	A. O. Co.	Purple	2.08	(*)	...	(*)	...	.745
Amethyst B	... do	... do	2.05	(*)	...	(*)	(*)	.70
Amethyst C	... do	... do	2.04	(*)	...	(*)	...	.55
Amethyst dark	W. & O.	... do	1.90	(*)	(*)	(*)	(*)	.705
Amethyst light	... do	... do	1.97	(*)	(*)	(*)	(*)	.805
Arkweld dark	King	... do.[b]	2.46	(*)	...	...	...	0+
Blue A	A. O. Co.	Blue	2.10	(*)	...	(*)	...	.88
Blue B	... do	... do	2.04	(*)	...	(*)	...	.62
Blue C	... do	... do	2.05	(*)	...	(*)	...	.35
Blue D	... do	... do	2.11	(*)	...	(*)	...	.062
Chlorophile	W. & O.	Yellow-green	1.98	(*)	(*)	(*)	(*)	.65
Chromatic test	A. O. Co.	Blue	2.36	(*)	...	(*)	...	.0075
Cobalt blue AA	... do	... do	2.75	(*)	...	(*)	...	.033
Cobalt blue A	... do	... do	3.20	(*)	...	(*)	(*)	.0.26
Cobalt blue B	... do	... do	1.85	(*)	...	(*)	...	.0085
Cobalt blue C	... do	... do	1.46	(*)	...	(*)	(*)	.0096
Cobalt blue D	... do	... do	1.86	(*)	...	(*)	...	.0055
Crookes A	W. & O.	Neutral	1.79	(*)	(*)	(*)	(*)	.84
Crookes B	... do	... do	1.93	(*)	(*)	(*)	(*)	.485
Crookes A, Wellsworth	A. O. Co.	... do	2.05	(*)	...	(*)	...	.85
Crookes B, Wellsworth	... do	... do	2.16	(*)	...	(*)	...	.45
Crown 1.50	... do	... do	1.68	(*)	...	(*)	(*)	.92
Electric smoke red	... do	Red-purple[b]	1.82	(*)	...	...	(*)	0+
Electric smoke Y	... do	Yellow[b]	2.01	(†)	...	...	...	0+
Euphos	... do	Yellow-Green	1.95	(*)	...	(*)	...	.72
Fieuzal	W. & O.	... do	1.98	(*)	(*)	(*)	(*)	.835
Fieuzal A	A. O. Co.	... do	2.13	(*)	...	(*)	...	.665
Fieuzal B	... do	... do	2.13	(*)	...	(*)	...	.51
Hallauer	W. & O.	Yellow-green	1.90	(*)	(*)	(*)	(*)	0.48
Laboratory No. 57	A. O. Co.	Neutral	1.90	(*)	...	(*)	(*)	.91
Laboratory No. 58	... do	Yellow	2.02	(*)	...	(*)	(*)	.815
Laboratory No. 59	... do	Blue-green	2.13	(*)	...	(*)	...	.32
Laboratory No. 61	... do	Yellow-green	2.13	(*)	...	(*)	...	.65
Luxfel	... do	Yellow	2.00	(*)	...	(*)	(*)	.835
Noviol AA	... do	... do	1.88	(*)	...	(*)	(*)	.88
Noviol A	... do	... do	2.06	(*)	...	(*)	...	.87
Noviol B	... do	... do	2.10	(*)	...	(*)	...	.85
Noviol C	... do	... do	2.10	...	...	(*)	...	.83
Noviol O	... do	... do	2.03	(*)	...	(*)	...	.85
Noviol A	Corning	... do	2.00	(*)	(*)	...	(*)	.865
Noviol A_1	... do	... do	2.88	(*)	(*)	...	...	.87
Noviol A_2	... do	... do	2.84	(*)	(*)	...	...	.85
Noviol B	... do	... do	1.95	(*)	(*)	...	(*)	.84
Noviol B_1	... do	... do	2.83	(*)	(*)	...	...	.845

Specimen, company's designation	Company	Color	Thickness in millimeters	Instrument [a]				Total transmission factor
				H	L-B	K-M	M	
Noviol C	... do	... do	2.00	(*)	(*)	...	(*)	.825
Noviol O	... do	... do	2.01	(*)	(*)	...	(*)	.865
Noviol O	Hardy	... do	1.94	(*)	(*)	...	(*)	.88
Noviweld 4	A. O. Co.	... do	1.89	(†)	...	(*)	(*)	.031
Noviweld 5	... do	... do	2.16	(†)	...	(*)	(*)	.014
Noviweld 6	... do	... do	2.20	(†)	...	(*)	(*)	.010
Noviweld 7	... do	... do	1.90	(†)	...	...	(*)	.006
Noviweld 8	... do	... do	2.01	(†)	...	...	(*)	.0032
Noviweld 12	... do	... do.[b]	2.08	(†)	...	...	...	0+
Pfund	... do	Green	(c)	(*)	...	(*)	(*)	.047
Rifleite	King	Yellow	3.14	(*)	(*)	...	...	.775
Saniweld dark	... do	... do	2.12	(†)	(*)	...	(*)	.0135
Saniweld light	... do	... do	1.82	(*)	(*)	...	(*)	.115
Smoke A	A. O. Co.	Neutral	2.10	(*)	...	(*)	(*)	.75
Smoke B	... do	... do	2.14	(*)	...	(*)	(*)	.38
Smoke C	... do	... do	2.13	(*)	...	(*)	(*)	.265
Smoke D	... do	... do	2.03	(*)	...	(*)	(*)	.092
Special Noviweld No. 8	Hardy	Yellow [b]	1.77	(†)	(*)	...	...	.0001
Special Welders dark	A. O. Co.	Green [b]	2.54	(*)	...	...	(*)	0+
Special welders light	... do	... do	1.68	(*)	...	(*)	(*)	.0105
Welders smoke dark	... do	Neutral	1.42	(*)	...	(*)	(*)	.056
Welding glass 1	C. E. S. Co.	Yellow	1.98	(†)	(*)	...	(*)	.0034
Welding glass 2	... do	... do	2.32	(†)	(*)	...	(*)	.045
Welding glass 3	... do	... do	1.50	(†)	(*)	...	(*)	.00885
Welding glass 4	... do	... do	1.48	(†)	(*)	...	(*)	.00885
Welding glass 5	... do	Red	1.87	(†)	(*)	...	(*)	.0027
Welding glass 6	... do	Yellow	1.97	(†)	(*)	...	(*)	.0705
1.52	A. O. Co.	Neutral	2.33	(*)	...	(*)	(*)	.92
91 B	Corning	... do	1.97	(*)	(*)	(*)	(*)	.84
124 IP	... do	Green	2.00	(*)	(*)	...	(*)	.015
124 JA	... do	Blue-green	2.02	(*)	(*)	...	(*)	.61
391 DD	... do	Red [b]	1.90	(†)	(*)	...	...	.0001
392 F	... do	Blue-green	1.90	(*)	(*)	...	(*)	.72

[a] H.=Hilger, L-B=Lummer-Brodhun, K-M=Koenig-Martens, M=Martens. An asterisk (*) indicates which instruments were used. A dagger (†) instead of an asterisk means that no transmission was detected from 230 to 500 millimicrons.

[b] Color very dense. [c] Gold film.

in which the per cent transmissions for different wave lengths were plotted against the wave lengths. By per cent transmission, the authors means that per cent of the incident radiant energy which gets thru the specimen. Those desiring to study these curves will find them in the original pamphlet to be obtained from the Government Printing Office.

The authors state that

"Of the specimens studied, the five kinds which are most efficient as protection against the ultraviolet, while being at the same time nearly colorless in the thicknesses examined, are 'Crookes A' (Figs. 3-4), Corning '91B' (Fig. 3), A. O. Co. 'Lab. No. 57' (Fig. 6), A. O. Co. 'Lab. No. 58' (Fig. 6) and 'Noviol O' (Figs. 7-9). Of these, 'Noviol O' and A. O. Co. 'Lab. No. 58' are the best, but

are not so truly colorless as the other three. Of the slightly colored glasses, by far the best seem to be 'Noviol A' (Figs. 8-9) and 'Noviol A_1' (Fig. 7), as they absorb completely below 410 mμ while transmitting about 87 per cent of the incident light. It is not thought that the slight color would be at all objectionable for ordinary use.

"A combination of 'Noviol A' (Figs. 8-9) and Corning '124JA' (Fig. 14) is very efficient for eye protection, as it absorbs all the ultraviolet and most of the infrared, and still has high visible transmission. The color is a very light green, and the colors of objects viewed thru it are distorted practically none at all. A gold film on 'Noviol A' glass would also be very efficient, tho transmitting less of the visible than the combination just mentioned.

"The yellow and yellow-green glasses (Figs. 7-13) of a deeper shade are usually good protection against the ultraviolet. The green and blue-green glasses of Fig. 14 are used primarily to protect the eye from the infrared. The 'Pfund' specimen is a gold film between two pieces of what seems to be 'Crookes' glass. 'Smoke' (Fig. 5), amethyst (Figs. 15-16), and blue (Figs. 17-18) or purple glasses are liable to be little better than clear glass as a protection against the ultraviolet. Of the welding glasses (Figs. 19-22), yellow seems to be the safest, as the green or neutral shades are liable to have transmission bands centering near 395 mμ, which may extend a considerable distance into the ultraviolet."

Observations on transmission factors follow and sample transmission curves are given with all values plotted, illustrating the kind of agreements and disagreements obtained on the different instruments employed in the various tests.

In an appendix are found forms suitable to be used in the specifications of eye protective glasses. The authors point out that

"It is desirable that those who wish to specify eye protective glasses should have at hand certain standard type forms for such specifications. The following forms, separately or in combination, as the case in hand may require, will be found, in general, suitable and adequate for this purpose:

"*1. For Protection from Ultraviolet.*—'The transmission shall not be greater than 0.01 for radiant energy of any wave length less than 406 millimicrons.'

"*2. For Protection from Heat.*—'The total transmission for radiant energy from a source having the spectral energy distribution of a complete radiator ('black body,' Wien equation) at 1500° absolute shall not be greater than.....'

"*3. For Protection from Intense Light while Allowing Sufficient Light for Work.*—'The total light transmission for light of equal energy at all wave lengths shall not be more than.....nor less than.....' This would approximate closely the total light transmission for sunlight. In some cases it might be desirable to make the specification in terms of the known spectral energy distribution of the standard acetylene flame or other source.

"The blank spaces in the above forms should be filled as found desirable in particular cases. Satisfactory glasses should be selected by trial under service conditions. The measured transmissions of these selected glasses will then serve as data for filling the blanks in the above forms."

The practical application of this form will become apparent with the publication of "A National Safety Code for the Protection of the Head and Eyes of Industrial Workers," with which the Bureau of Standards has been engaged for some years past, and in the compilation of which your committee has been referred to for advice and cooperation. This excellent piece of work of the Bureau will soon be finished and is also recommended to the members of the Section for their careful consideration.

In concluding this report, it may be of interest to recall that the investigations made by Drs. C. E. Ferree and A. G. Rand regarding the effects of various forms of illumination under different modes of distribution were initiated and to a degree guided by our committee, of which Dr. Ferree was a member.

Respectfully submitted,

WM. CAMPBELL POSEY,
Chairman.

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ABSTRACTS

Rinkes-Huygen, A. C. Treatment of Gonococcus Conjunctivitis. Doctorate Thesis, Amsterdam.

The thesis begins with a historical survey of which a few points can be mentioned. In 1807 Gibson advocated treating vaginal disease of the mother during pregnancy, to remove during parturition the secretion from the vagina; and to wash out the eyes of the new-born directly with a fluid for removal of the materia peccans. To these precepts attention was given only when Piringer distinctly proved that conjunctivitis gonorrhoica originates only if secretion from a diseased mucous membrane has come in some way in the eye.

Credé's merit is the application of a 2% solution of silver nitrat to all the newborn in the clinic. Cramer found in 300 cases that instillation of 2% silver nitrat is always followed by reaction. In 96% secretion appeared, which in 23% had not ceased after 5 days Experience has taught that for prevention of corneal lesions it is better not to drop on the cornea, but at the inner angle; and to replace the 2% by the equally efficacious 1% solution.

Potassium permanganat 3% was recommended in 1882 by Stellwag. In 1892 Terson irrigated the conjunctival sac with 1:2000 or 1:5000, and in 1894 Kalt recommended free irrigations with 1:5000. In 1914 Fehr published statistics of treatment consisting of rest in bed, ice compresses as long as the cornea was intact, and irrigations with the permanganat every hour, even during the night.

Once a day the palpebral conjunctiva was treated with 1% silver nitrat, and atropin salve and lenicet salve were put in the conjunctival sac, for protection of the cornea. With severe chemosis the conjunctiva was scarified; while with corneal ulcers if necessary cauterization and the conjunctival plastic operation, after Kuhnt, were done. The sound eye was protected by a bandage, and this was renewed daily until the secretion of the diseased eye had ceased and no gonococci could be demonstrated in the secretion.

Between April, 1907, and March, 1914, 53 eyes of 45 patients, of which 36 were adults or older children were treated. On admittance 31 eyes had the cornea intact. During the treatment 25 corneas remained clear; 6 eyes had corneal complications, 4 of which were cured entirely, and 2 got leucomata (1 without useful vision); 22 corneas showed corneal complications, in 6 the cornea was destroyed, 9 were discharged with vision 1/2 to 1.; 5 with corneal maculae but useful vision; 5 with reduced vision, but can be probably improved by operation, 1 with phthisis bulbi and 2 were enucleated, 72% are therefore cured, 6 have retained useful vision and 17% have been lost.

In the Amsterdam clinic the following treatment was applied: as long as there was secretion the patients remain in bed, and the nonaffected eye is protected by a watch-glass. The affected eye is often cleansed, in very serious cases even every 5 minutes, when the eye is slightly opened, for removal of the pus thru small motions of the eyelids. For cleansing usually 1/5000 sublimat is used. Twice daily, or more often, the eye is irrigated with Straub's syringe, with 1/1000 potassium permanganat; and if the condi-

tion does not improve the eyelids are turned and treated with 2% silver nitrat. If this does not reduce the swelling and redness of the conjunctiva copper sulphat in substance is applied. Atropin is used with corneal complications. Patients are discharged when the conjunctiva becomes thin and smooth, and gonococci can no longer be demonstrated.

Of newborn children 24, with 48 affected eyes, were treated without irrigation, only with silver nitrat and cleansing. Of these 27 corneas were intact, 7 of which had complications (twice in both eyes), 6 got large maculas, in one the opacity was moderate. The other 21 corneas were affected, of them 6 became clear, 9 were discharged with moderate maculas, and 6 with large maculas. In 22% of eyes with intact corneas an important diminution of the vision took place.

Of 21 cases with corneal complications, 5 retained useful vision. The treatment of uncomplicated cases was 3 weeks or shorter in over 50% and the same for 29% of the complicated cases. But for about 57% of the latter it was longer than 5 weeks. Under this treatment 211 eyes of the new born and 59 eyes of adults and older children were observed. In the new born 132 eyes with intact cornea 10 had corneal complications (one traumatic, 3 times insufficient care, and twice general poor condition); 9 times the cornea became perfectly clear or only small peripheric maculae remained. Corneal complications occurred in 79 eyes, 3 with perforation. The cornea became clear in 47. Of the older patients 31 corneas were intact, among which corneal complications appeared twice (one discharged with V. 3/4, and one with 2/3). There were 26 eyes that came with complications (6 with perforating ulcer). In 19 the cornea cleared up, or slight maculae remained, 3 times central maculae (V=1/6). The eye was blind or about so on discharge in 6. Once exenteration was necessary. Good vision remained in eyes with affected cornea in about 70%.

The writer does not like to recommend lenicet salve, because the illusion, that one uses a specific, may prevent the good care, which the other method asks for. Heat applications, recommended by Goldzieher in 1911, invite further trial. One must be sure that the conjunctiva comes in contact with the watery vapor of the wished for temperature. With vapor of a lower temperature the aim of killing the gonococci will not be reached; while vapor of too high temperature may damage the eye. In the last year it has been tried to elevate the temperature in the conjunctival sac with diathermia: an alternating current of very high frequency and tension goes thru the organ. The frequency oscillates between 1 to 6 million in the second; and a current of 1/2 to 3 ampères and even more can be used without damage. In ophthalmic practice one will do well not to use a current stronger than 1/2 ampère. Five cases of conjunctival gonorrhea were treated with diathermia. In the first case, which was on the way to recovery, when the diathermia treatment was applied, the secretion ceased after 4 days, and the eyes became quiet. Distinct proofs of acceleration of the cure are not present.

A similar conclusion must be drawn in the second case; which healed no quicker or better than other cases, which were treated without diathermia with frequent washings and permanganate irrigations. The third case, which was taken up with severe acute inflammation, after 3 days with diathermia distinctly was improved. The gonococci, however, were not killed, they could still be demonstrated after 24 days. In the fourth case neither the diathermia nor the injection of typhoid vaccine had any distinct result. The fifth case had a very favorable course; it is difficult to know the influence of the diathermia and the vaccine, but the physicians were convinced that the therapy produced the favorable change.

The results of the diathermia depend on the temperature which the patient will stand, and this will be insufficient in sensitive patients for damaging seriously the gonococci in a short time. The heat must be controlled and ap-

plied a sufficiently long time—at least 10 to 15 minutes—if conclusions can be drawn from the effect, credited to this therapy. The temperature cannot be controlled objectively; and this excludes treatment of the new born.

The chemotherapy (Roemer, Loehlein and Gebb) has not proven valuable, and the same can be said of trypaflavin. In two clinical cases trypaflavin was used without apparent success. It induced the writer to try its effect on rabbits' eyes. If during two successive days with intermissions of at least 3 hours only 6 times one drop of trypaflavin 1% is dropped in the conjunctival sac of an adult rabbit, the cornea shows slight lesions, while the same treatment with ½% distinctly affects the cornea of the young rabbit. She finds no reason to recommend this remedy.

Under albumin therapy the writer considers together all those methods, where albuminous substances as milk, normal or antitoxic serum, or auto—or heterovaccine is applied, externally as wash or irrigation, or as parenteral, subcutaneous, intramuscular and intravenous injections. These all are still in the experimental stage. We know nothing about the essence of this therapy and the factors are unknown why in one case a favorable result is reached and not in another. The dangers of injection of foreign albumin are the anaphylactic symptoms. Without a great probability of therapeutic success and the certainty that the body will not undergo a permanent harm, the injection of complicated albumins, as milk and serum, is not allowed. Here also exists the possibility of fat embolism with milk injection, and local necrosis at the place of injection with both. As long as the therapeutic effect is so very uncertain the albumin injections are not allowable, because at the present stage of science we use a weapon, the effect of which we do not know.

Renaud in 1911 mentioned cure in different local infections with injection of typhoid vaccine. Paul von Szily and Aladar Sternberg used typhoid vaccine in acute ophthalmoblennorrhea in 1917. Haab also published favorable results in the next year. This justifies further examination in this direction. Three cases received these injections in Amsterdam: the very favorable course in the first, and the apparent even if only temporary improvement in the third, have disposed the writer favorably; they justify continuation, but can never be a reason to neglect the approved methods of care and treatment.

The therapy with milk injections cannot claim to be trustworthy therapy. With its possible dangers it is far less to be recommended than the vaccinetherapy, even if the future still has to demonstrate the value of the latter proceedure.

E. E. B.

Santos Fernandez, J. Congenital Detachment of Retina. Revista Cubana de Oftalmologia, 1920, No. 2.

This affection is not frequently seen congenitally. The author has only seen four cases, in over 62,000 eye patients, two of them 28 years ago and the other two very recently. The last cases were seen in the same month, both in young girls, in one of them the detachment was bilateral. One of these cases was diagnosed as glioma of the retina by a colleague, and the author was really at first in doubt. But after obtaining the history of the case, the diagnosis was established, and enucleation was very emphatically condemned. The subsequent course of the disease confirmed the diagnosis.

The second case was in a young boy, a month and a half old, the last of six children, all the others being well. The parents noticed since birth a white veil in both pupils, and the author was able to diagnose detachment of both retinas.

Case third, was of a girl three years old, whose father noticed since she was able to see, that there was a yellowish reflex in her right eye. This was diagnosed three years before as "cancer," by a rural practitioner; but it was a case of unilateral detachment.

Case fourth, another girl, fifteen days after her birth, the family noticed something strange in both eyes. The same reflex as in the three other cases.

The ophthalmoscope revealed the bilateral detachment.

Kennon, B. R. Detachment of Retina in Three Children of a Family. Virginia Medical Monthly, v. 47, p. 175, July, 1920.

Two brothers and a sister in a family of five children were affected with detachment of the retina, altho the family history was otherwise negative.

There was no myopia, or evidence of other ocular disease, except that the girl, aged 15, had floating opacities and fluid vitreous in her other eye. One brother gave an indefinite history of injury while playing football six weeks before. The other had been struck in the left eye by an oyster shell some weeks before. In the other brother and the sister it was the right eye that was affected.

Treatment produced no permanent improvement, altho evacuation of the fluid by scleral trephining caused temporary improvement in the most clearly traumatic case.

E. J.

von Szily, A. Spontaneous Internal Fistula of Lacrimal Sac. Klin. M. f. Augenh., v. 64, January, 1920, p. 31., ili.

Von Szily introduces this internal fistula as a new type of disease of the tear passages, leaving it to further investigation to clear up the pathogenesis of this form of fistula. Two cases are described, in which, without preceding phlegmon of the tear sac a fistula had formed with a stenosis at the place of predilection opposite the middle turbinated body thru which the irrigation fluid ran into the nose.

The anatomic relations of the fossa lacrimalis to the lateral wall of the nose and to the accessory sinuses, and the pathogenesis of the fistula interna are discussed in detail. There are 2 modes of pathogenesis suggested: Empyema of the ethmoid, which erodes the medial wall of the lacrimal sac, besides tubercular changes. Or the inflammation may start from the tear sac. Enlargement and diverticulum of the sac, as well as simultaneous congenital or spontaneous resorption. Openings of the lacrimal bone, as frequently observed in older people, may contribute. Stenosis of the duct is present in a part of the cases, but is not an essential preliminary to the origin of the fistula.

The fistula interna, may, especially in stenosis of the duct, by sufficient drainage of the secretion to the nose, finally lead to spontaneous healing of the dacryocystitis. Spontaneous communications between the medial wall of the tear sac and the nasal cavity may arise at the site of the endonasal operation of Polyak-West. In the majority of cases, however, extirpation of the lacrimal sac; and in established ethmoiditis, opening of the ethmoid cells are indicated.

The diagnosis of fistula interna could only be made by means of Roentgen rays after injecting a shadow giving mass into the lacrimal passages, for which von Szily used at first bismuth and later on impalable oxid of thorium, triturated in liquid paraffin. In case I, the outflow of the irrigation fluid and the fistula could be directly observed. Two plates illustrate the skiagraphs.

C. Zimmermann.

Duane, A. Theoretical and Practical Points in Refraction Work. Archives of Ophthalmology, v. 49, 1920, p. 349.

Some of the theoretic considerations brought out in this paper cannot well be abstracted, but the following may be taken with regard to the significance of the cardinal points. He says:

"1. The position of the posterior focus with relation to the retina determines whether the eye is emmetropic, hypermetropic, or myopic.

"2. The position of the posterior nodal point with relation to the retina determines the size of the retinal image and has, therefore, a bearing on the apparent size of objects and on visual acuity.

"3. The main effect of glasses placed in front of the eye is not to change the refractive power of the latter but to shift the position of the cardinal points—putting the posterior focus of the eye (F) on or off the ret-

ina, and changing the position of the posterior nodal point (K) with relation to the latter.

"4. If a glass is placed at the anterior focus of the eye—and this is the regular place for correcting glasses—it makes absolutely no change in the refractive power of the eye. That is, a+10 D. lens placed 14 mm. in front of the cornea has no effect whatever on the posterior focal distance of the eye which remains 21.1 mm. What is does do is to shift the posterior focus of the eye and also the posterior nodal point of the eye some 3 mm. forward and thus exert a marked and determinate effect on the clearness of retinal images.

"5. On account of this and other properties, the anterior focus of the eye is the point where we should place glasses to be worn, where we should place the ophthalmoscope in applying the direct method, and from which we should make our measurements in determining the far point and near point of accommodation."

Usually in calculating the constants of the eye, the effect of the posterior surface of the cornea is neglected. It is not, however, a negligible quantity. Thus if we use the latest measurements of Tscherning in calculating the constants of the eye, the difference corresponds to a difference of a whole diopter in refraction.

Regarding the size of the pupil, Duane points out, the pupil as we see it thru the magnifying lens formed by the cornea is about one-ninth larger than the actual pupil. But this apparent pupil, "inlet" pupil as Abbe calls it, measures accurately the width of the beam of rays that can find its way thru the actual pupil. That is, a pupil really 4.5 mm. in diameter, and which appears to us to be 5 mm. in diameter will admit a beam of rays that occupies a circle of the cornea that is 5 mm. in diameter.

Opposed to this "inlet" pupil is the "outlet" pupil, or image of the pupil formed by the crystalline lens. It is this figure which really forms the base of the cone of rays directed toward the retina, and determines therefore the size of diffusion images. It is, however, very little larger than the pupil itself.

As to change of refraction in the development of the eye, he says: We often get a wrong conception of the change that takes place in the refractive state of the eye between infancy and adult life, when we think of it as change caused by simple elongation of the eyeball, converting a primitive axial hyperopia into emmetropia and in many cases into myopia. A moment's consideration shows that this is a very partial representation of what takes place. The infant's eye is so short that, built on anything like the refractive scheme of the adult, it would have an axial hyperopia of 20 D. As in reality it is usually hyperopic only 2 or 3 D. at most—and sometimes not hyperopic at all—it is evident that in the early years of life we have a combination of two factors—an axial shortening sufficient to cause a hyperopia of 20 D. and an excess of curvature sufficient to cause a myopia of some 18 D. This excess of curvature must be located in the lens, since the cornea is not very much more curved in the infant than in the adult. As the child grows, two opposing processes occur simultaneously. The excessive curvature of the lens diminishes, causing a reduction of the curvature myopia; and the eyeball elongates, causing a reduction of the axial hyperopia. Usually, but not invariably, the latter process predominates so that the eye as a whole tends to grow less hyperopic—strives to become emmetropic. It is rather remarkable that a process composed of two opposing and simultaneously diminishing factors should not present more variations than it does, and that there should be on the whole a steady progress toward emmetropia—even if this does often fall short of the mark or overshoot it.

Among the practical points emphasized in this paper, Duane says, "In the great majority of cases the refraction of the eye cannot be determined with certainty without the use of cycloplegics. This statement applies to astigmatism as well as to hyperopia and to

both more than it does to myopia." There is also necessity for making a careful test of the eye in its natural condition, and in a very large number of cases, by so doing we may arrive at the same result as under a cycloplegic. But as one can never be sure in any given instance that this will be the case, and as in some cases there is reason to think that the results would be the same they have turned out to be different, we should give ourselves and the patient the added certainty that the use of the cycloplegic affords."

To the objections urged against the use of cycloplegics, the above facts meet the claim that they are useless.

That cycloplegia often fails to disclose the true refraction, Duane cannot corroborate from his experience, if cycloplegics are used in the proper strength and if their action is checked by the accommodation tests. Once in a while the tests are contradictory or unsatisfactory under homatropin and atropin must be used.

As to the danger of cycloplegia causing glaucoma, this has appeared but once in his entire experience. "Furthermore, an eye which develops glaucoma under a cycloplegic is an eye which is going to develop glaucoma anyhow. It is not an unmixed evil then if it develops it right before our eyes. We can usually control the increase of tension with eserin, or, failing that, with a paracentesis; and then do the iridectomy that such a case should in any event have."

Contrary to what is often stated, he has found that it is even more necessary to use a cycloplegic in middle life than in youth. Those of middle life often relax the accommodation imperfectly or with difficulty, and are often rather resistant to cycloplegics. The more flexible ciliary muscle of youth usually relaxes more readily. He uses a cycloplegic in practically all cases up to forty-eight, and sometimes after that age.

In a previous paper he has cited nineteen cases of patients between forty and forty-nine, in whom homatropin had disclosed latent hyperopia of anywhere from 0.62 to 3.00 D. and latent astigmatism of from 0.25 to 1.00 D. What was particularly significant was that sometimes considerably more error was latent in one eye than in the other, so that no conceivable equal addition to the manifest correction would have given a glass satisfactory to both eyes.

To determine whether or not we get complete cycloplegia we should systematically employ the accommodation tests, taking the accommodation before and during the instillations until the range has been reduced to below a diopter. The period of complete cycloplegia occurs at a time varying anywhere from forty minutes to two hours or more. Tests taken when the accommodation is not thus completely relaxed are apt to give wrong results.

When there is a large disagreement between the precycloplegic and the cycloplegic findings a postcycloplegic test is insisted on. This should be made not less than four days after the cycloplegic, since some traces of the latter often persists for this length of time, as shown by the accommodation tests; and if we make the test too soon we are likely to prescribe a glass that will be uncomfortably strong or one that will blur the distant vision. Duane prefers to make his postcycloplegic tests not less than a week after the cycloplegic, particularly when it is a question of giving a presbyopic glass based on the cycloplegic findings. Here we wish to be particularly careful that the full power of accommodation has returned.

Careful repeated tests should be made of the accommodation and muscles. Insufficiencies of accommodation are of great importance at all ages, tho particularly in the young, and if they are not recognized and treated, the results of correction of the refraction may be disappointing. Contrary to the view expressed by Hess and others, insufficiency of accommodation is of significance and can be made out in persons of the presbyopic age.

The determination of the muscle balance for far, and especially for near points, is of great significance in our refractive work. In the presence of a

convergence excess we crowd our hyperopic correction. In the presence of a convergence insufficiency, evidenced by a marked exophoria for near and a remote convergence near point, we are careful not to give a strong presbyopic correction, which in just these cases is badly tolerated. In cases of hyperphoria we may have to add a vertical prism or in certain cases a prism paster to insure comfortable vision.

Among factors governing the treatment of a refractive error Duane mentions the following: the age of the patient, the vision, the amount and kind of use to which the eye is put, the symptoms and their obvious relation to the use of the eye, the accommodation and the associated muscular conditions, and the general symptoms and general condition of the patient.

He sums up the handling of refraction cases in these two maxims: "First, let us find out all we can about the eye we are treating and the symptoms of which they are a part; using to this end every means that experience has proved to be helpful, never doing the work in a hurry, and remembering always that this work of all others requires patience, thoroness and accuracy.

"Second, let us constantly bear in mind the fact that we are treating patients, not eyes; we are handling human beings, not machines; and that we cannot do our best work unless in each case we put ourselves in touch with the individual man before us, showing sympathy for his troubles, consideration for his infirmities, and an understanding mind to take in all the physical and mental factors which may affect his outlook on life and determine his need for refractive or other correction."

E. J.

Gonzalez, Jose J. Complicated Eye Strain and Similar Conditions. Revista Cubana de Oftalmologia, 1919; p. 553.

In the course of the past twenty years, the author has seen a large number of cases with new symptoms of eye strain; and some others that are called by him, the equivalent of eye strain.

In the first group of cases the author has seen, hyperthermia and delirium as well as alternating paralysis, and even attacks of apoplexy, complicating the ordinary symptoms of eye strain. Another not very uncommon complication seen by the author is aphasia, four cases of that complication having been observed by Gonzalez. Other cases have had some subjective disturbances of the sensibility, and in still others there have been seen amnesias and hypermnesia or hyperimagination. Some of the cases observed have had some ocular disturbance, like painful feelings, ocular paralysis and oculo-sympathetic symptoms; and in some others the visual symptoms have been more marked, this subgroup of cases forming the majority of the cases of what is generally called eye strain, in many of which there was some form of scotoma.

In the second group of cases, those called by Gonzalez, "equivalents" to the eye strain, there were periodical attacks of gastric, nasal, and other troubles, like vertigo, pseudoangina pectoris and pseudoepilepsy. Among the chief symptoms observed were a pseudocoryza, p a i n f u l deglutition, marked reddening of the lobe of the ears, restlessness, tachycardia, pains in the spinal region, and at other times diminution in the frequency of the pulse.

The author believes that all the facts speak in favor of the vasomotor origin of the eye strain in many of the cases mentioned; and that these vasomotor disturbances have a still undefined relation to the sympathetic. The periodic irritation of the sympathetic is probably due to some autointoxication.

These intense symptoms complicating eye strain are in the opinion of Gonzalez, a neurosis of the cervical sympathetic, due to some autointoxication, whose wide variety of symptoms and whose true character could not be exactly explained until the exact physiology of the glands of internal secretion is known.

F. M. F.

Rönne, Henning. A Form of Non-syphilitic Parenchymatous Keratitis.—Hospitals tidende, Vol. 63, No. 11, p. 16.

The author presented 2 case histories of parenchymatous keratitis, both in adults, in which no suspicion otherwise existed of syphilis, Wassermann negative, each running a course of 4 or 5 months, with recovery. One case gave a history of some form of multiple joint affections, and the other of a series of light attacks of iritis.

D. L. T.

Hueber, A. A. Transverse Muscle of Orbit. Royal Academy of Sciences, Amsterdam, Nov. 30, 1918. Part 27.

A. A. Hueber found this muscle in both orbits, but differing from the case described by Bochdalek (1868).

In the left orbit, the muscle arose from the anterior part of the ethmoidal plate about 2 mm. behind the trochlea, as a flat tendon about 7 mm. in width. The tendon fibers quickly merged into muscular fibers, while laterally the muscle became smaller and rounder, being only 2 mm. broad when it passed at right angles below the superior oblique. Muscle fibers coming from the medial border of the levator bend medially and join the transverse about 1 cm. from the medial orbital wall, causing it to become broader and flatter. Farther laterally the transverse pierces the levator as symmetrically so, that only a small bundle, about 3 mm. in width, passes under the transverse muscle, the major portion being above. At their crossing the transverse measures about 4 mm. and the levator about 10 mm. Laterally from this place of crossing the transverse becomes a thin flat tendon, which is attached to the lateral orbital wall, below the lower border of the lacrimal gland.

After the crossing, the levator divides in the usual way into a superior and inferior part; but the relations of the inferior part deviate somewhat from the normal. It forms a strongly developed portion of smooth muscle, the superior tarsalis muscle, having a lateral border about 3 mm. long and fused with the capsule of Tenon. This inferior part continues normally and is attached at the upper margin of the tarsus. The medial part has the same points of attachment as the superior, then at this side both parts are connected. The lateral part had a larger extension, reached further posteriorly and connected with the lateral extension of the transverse muscle, and both form a tendinous extension attached below the lacrimal gland on the lateral orbital wall as a flat tendon about 20 mm. broad, which was also fused with Tenon's capsule. The chief portion of the orbital part of the lacrimal gland was found on the tendinous extension formed by the transverse and levator; while a small part stretched forward over the lateral border of the superior part of the levator. The conjunctival part of the lacrimal gland was present between the two parts of the levator.

The right transverse muscle was more developed than the left, and ran more below the levator. Here it appears without other abnormal muscles, so that there is no gracilis as in Bochdalek's case. Its contact with the levator cannot be called intimate, since no fibers of the transverse bend forward, the connection between the fibers of the transverse and the levator is not inseparable, and we cannot say the levator is pierced by the transverse since only a few thin fibers of the levator pass under it. The chief points of similarity are the connection of the inferior part of the levator, with the capsule of Tenon, and the relation with the lacrimal gland.

The innervation of the transverse could not be determined because the covering of fat had been removed in both orbits before the muscle was found. Hueber does not share Macalister's opinion that the transversus should be a dislocated deep palpebral part of the orbicularis, since the connection of the transverse with the levator is too important.

E. E. B.

Howard, H. J. A Uniform System of Eye Tests. The China Medical Journal, May, 1920.

The value of comparing results of any kind is proportionate to the uniformity of methods applied in obtaining those results. When different forms of apparatus, different tests, and a different application of the same tests are used to determine the respective ability or condition of certain ocular functions, the task of correlating the results is almost hopeless.

It is not anticipated that we shall undertake to perform routinely all the tests suggested. But it is hoped that they may constitute the basis of many of our examinations.

OUTLINE OF TESTS.

1. Inspection. Bright daylight preferable; record only pathologic conditions. A. Lids. B. Tear sacs and puncta. C. Conjunctivae. D. Corneae. E. Pupils: 1. Size. 2. Equality. 3. Shape. 4. Reaction to Light and Accommodation.

F. Eyeball: 1. Tension (Waine tonometer). 2. Shape. 3. Nystagmus.

G. Anthropometric measurements. (Record in mm. These measurements are important from standpoint of research.) 1. Interpupillary distance (see VI). 2. Amount of exophthalmos. 3. Distance between the two internal canthi. 4. Distance between internal and external canthus of each eye. 5. Horizontal and vertical diameters of cornea. 6. Development of an epicanthus or a Mongolian fold, i. e., either none, slight, moderate, or pronounced.

II. Visual Acuity. R. E. ..... L. E. .....

III. Manifest Refraction.

R. E. ..... Vision .....
L. E. ..... Vision .....

IV. Accommodation. (With distance correction on, measure in diopters from the anterior focus of the eye, which is 11.5 mm. in front of the cornea; use the Prince rule and the Duane disc; test each eye separately.)

V. Near Point of Convergence. (With emetropic correction on, or if subject is presbyopic with near correction on, measure in mm. from the center of rotation of the eyeball, i. e., 25 mm. must be added to the measurement made from the anterior focus.

VI. Interpupillary Distance. (Measured in mm. while looking at distance.)

VII. Angle of Convergence. $= \frac{\text{½ interpupillary distance} \times 100}{\text{near point of convergence}} + 3$

VIII. Binocular Single Vision. A. Near. 1. Hand stereoscope and stereoscopic picture test. 2. Or bar reading. B. Distance. 1. Have patient look at small spot light with a red glass before one eye. 2. Or use six meter stereoscopoptometer test. This tests not only binocular single vision but also depth perception and judgment of distance. Important in testing applicants for aviation service.

IX. Ocular Movements. A. Maddox rod screen test, or the screen and parallax test. (Record deviation in prism diopters.)

1. At 6 meters: Esophoria or esotropia..... Exophoria or exotropia.

R. Hyperphoria or Hypertropia.....
L. Hyperphoria or Hypertropia.....

2. At 33 cm. Esophoria or esotropia.... Exophoria or exotropia.... B. Prism convergence power at 6 meters. C. Prism divergence power at 6 meters. D. Prism sursumvergence power at 6 meters. E. Prism convergence power at 33 cm. F. Associated parallel movements.

X. Central Color Vision. (Jennings' self-recording test is suggested.) Each eye separately.

XI. Fields of Vision for Form and Color. Good daylight or artificial light. R. E..... L. E.....

XII. Refraction. (Homatropin or atropin cycloplegia if possible; if not, employ fogging method.) Each eye separately. A. Total latent error: B. Trial case result with vision. C. Amount of presbyopia. D. Glasses prescribed: Distance. Near.

XIII. Ophthalmoscopic examination. (Record every pathologic condition.) A. Media—cornea, aqueous including depth of chamber, lens, vitre-

ous. B. Iris. C. Disc. D. Blood vessels. E. Retina. F. Choroid.

XIV. Diagnosis or Summary of Pathologic Conditions.

E. J.

Jess, A. Determination of the Position of and Removal of Foreign Bodies After Penetrating Injuries of the Eyes. Zent. f. d. ges. Ophth. u. i. Grenzgeb, v. 3, 1920, p. 1.

In contrast to peace time injuries war time foreign bodies are usually jagged and of irregular form. Their magnetic quality is dependent on the material used in making the shell, grenades, etc., from which they come. Not all foreign bodies are magnetic or even metallic, as the war caused a large number of injuries by pieces of stone, grains of sand, and splinters of wood and glass. If the condition of the eye is not such as to permit an ophthalmoscopic examination, roentgenography should be used to determine whether or not the object is within the eye; in spite of any possible danger of injury by X-rays to the eye or neighboring structures.

The author describes several ways of determining the position of the foreign body either by specially constructed apparatus, or by observation of the position of its shadow when the eye is turned in different directions. Even with the best method and the greatest care, particles were sometimes not found, as many of them were very minute. The sideroscope should be used in such cases, altho it merely proves the presence of iron and not its location in the eye. The giant magnet should also be used, the presence or absence of pain being a strong diagnostic aid. Since siderosis develops more rapidly in war wounds than in peace, early removal of the foreign body is imperative. This is more difficult than in peace injuries, because the terrific force of the penetration often embeds the particle in the tissues, and this is made more serious by their jagged outlines. The article is chiefly a review of the work of other men, and closes with an extensive bibliography.

C. L.

American Journal of Ophthalmology

Series 3, Vol. 3, No. 9 September, 1920

PUBLISHED MONTHLY BY THE OPHTHALMIC PUBLISHING COMPANY

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AMERICAN JOURNAL OF OPHTHALMOLOGY, 7 West Madison St., Chicago, Ill.

GLAUCOMA.

The statement that "glaucoma is increased intraocular tension with the causes and results of such increase," reflected fairly well the general understanding of it twenty years ago. The meaning of the word had evolved slowly, from blindness with a greenish, shining, dilated pupil, thru appreciation of exacerbations and inflammatory attacks, to some understanding of increased intraocular pressure and a search for the causes and mechanism of such increase.

It was thought that if only we could learn to recognize the beginnings of the increase, perhaps causes might be removed and the disease controlled. The tonometer worked out by Schiötz proved a practical clinical instrument. It did help us to recognize slighter changes of intraocular tension, and with greater certainty and accuracy to measure their amount. Our knowledge of intraocular pressure was extended and made more exact; but this has only added to the number and complexity of the problems we have to solve with reference to glaucoma.

From the use of such an instrument, we soon learned that its readings, valuable as they are, do not tell us the absolute intraocular pressure. But when compared with previous readings from the same eye, they tell with great certainty of the direction and extent of changes in pressure; and when compared with those of the fellow eye they indicate with great probability the differences of pressure between the two. Still they cannot be regarded as showing the exact number of millimeters of mercury of the hydrostatic pressure to which the interior of the eye is being subjected.

Nor has the tonometer settled the limits of normal intraocular pressure, either absolute in millimeters of mercury, or in readings of the instrument. We have attained a good idea of about what the pressure is in most normal eyes; but there is still reason to ask, does it vary normally within narrow limits, like the body temperature, or more widely like the blood pressure or the pulse rate?

Again, we have learned with regard to intraocular tension that a symptom

is not a disease; and no symptom is pathognomonic. Simple glaucoma can exist without increased tension; and the search for suspected periods of slight temporary increase in such cases has only added to the confusion; since such increases if they exist are quite within the normal limits as found in other eyes.

On the other hand, very striking increase of intraocular tension, pressures of 50, 60 or even 70 mm. of mercury, as such pressures are commonly described, may be found in connection with uveitis or other uveal disease; and the tension found subsequently drop quite within normal limits of 20 to 30 mm.; and the eye becomes and remains comfortable with recovered vision, and with no sign of glaucoma even after several years. Evidently we can have increased tension without glaucoma, if by glaucoma we mean a disease that tends to persist and become progressively worse until it destroys sight.

Changes in our knowledge of the significance of increased ocular tension must change our ideas regarding treatment. If the eye is going to return to normal tension without it, an operation that immediately gives relief from pain, must seem to have a very satisfactory effect; and without careful consideration may be taken to have a permanently curative effect that does not belong to it. On the other hand, the same operation, giving equally prompt relief in a case with no tendency to permanent recovery from the uveal disease that underlies the increase of intraocular pressure, might easily be ranked as a failure. Its real value being that it simply gives temporary relief which allows spontaneous permanent recovery in one case; while in the other the tendency to spontaneous recovery is lacking.

The number of papers relating to glaucoma that have recently appeared in the literature is an indication of much thinking about this subject, that is being done also by ophthalmologists who do not write about it. However, inconclusive most of these papers may be, they serve to keep thought stirring with regard to it. By reviewing the ratiocinations of others one is often able to get a more secure grasp of the subject in his own thinking; and some day a new fact introduced into this thinking will crystallize it, giving solid positive knowledge in place of the mixture of unrelated facts and speculation. Best of all, discussion of possibilities may stimulate one to determine the fact, by closer observation or carefully devised crucial experiment.

E. J.

BINOCULAR DISCRIMINATION OF DISTANCE.

Since the war and the examination of candidate flyers the ophthalmologists of America have become more interested in the problem of binocular single vision. It seems that the study of its literature should be made possible for those who cannot read the original Dutch article, to which I have, more than once, had occasion to refer, by Dr. G. J. Schoute, reporting investigations made with Brooksbank James' instrument.

Schoute published in 1910 his article on "Binocular Vision" in the Nederl. Tydschr. v. Geneesk. where for the first time attention was called, outside the British Empire, to James' instrument. I find no reference later in the literature until the writer's paper before the ophthalmologic section of the A. M. A., in 1917. The only change Schoute made in the instrument was that he used medium thick white threads, instead of the wooden pins. Because the observer did not look alone at the distance of the two broad rods; but also at their apparent thickness; and it was not easy to keep the illumination alike on the two rods.

James had mentioned the influence not only of the visual acuity but also of the pupillary distance. Schoute examined 82 persons, who had in each eye vision = 10/10, and orthophoria with the Maddox rod; 40 cases with the same vision and 1° esophoria, and 59 with exophoria 1°. They all had about the same binocular vision. He arranged a table of these 181 cases ac-

cording to the length of the base line, the only thing in which they differed.

The averages of those columns, which contained enough observations, show small differences roughly proportional to changes of the base line. The larger the base line, the better the binocular vision. Seen from 5 meters, the average of differences of distance in centimeters, from these two threads, that could be recognized was:

Base line less than 60 mm....4.05 cm.
Base line 60 to 64 mm.....3.15 cm.
Base line 65 mm. or over....2.60 cm.

Hence in the application of this eminently practical method, account should be taken of the length of the base line.

To make this method clinically useful it is necessary to search for the causes of the individual differences. Schoute could not give anything positive. He only found the wider separations, pointing to a poor binocular vision, nearly always in children. Therefore an investigation of the influence of age on binocular vision should be undertaken.

Another point in his table is the remarkably large difference between the theoretically supposed acuteness of the binocular vision, and the results practically found. The binocular vision is on an average three times as sharp as was expected. Among another 277 cases with equal acuteness of vision in both eyes, and normal fixation, 1° exophoria with Maddox rod, only 7 were found who had less sharp binocular vision than expected by the theory. It is therefore a rule with rare exceptions. Parallax thru head motion was excluded. Small motions of the head seem to have only a very slight effect.

Brooksbank James had a second theory, that the stereoscopic vision diminishes with the visual acuity. To determine this the most appropriate subjects for testing are men whose visual acuity is equally diminished in both eyes. Because for them the difference in distance can be computed which should be recognized if this supposition be correct. Such cases, however, are not so numerous. Schoute could examine 102 cases. They were tabulated, arranged in the vertical direction according to the visual acuity, and in the horizontal direction according to the length of the base line. He found the average differences of distance which was still recognized with a certain visual acuity, and that which ought to be so recognized according to Dr. James. Because of the small number of observations the influence of the length of the base line is buried among the individual differences.

But on consideration of the averages of table I, it was seen that the stereoscopic vision in most cases is much finer than would be expected from computation. In spite of this the stereoscopic vision goes to a certain degree parallel with the visual acuity. When this becomes poorer the power to judge of differences of distance decreases, and this decrease begins with the first diminution. With V. = 5/10 the first person appears who cannot recognize a difference in distance of 30 centimeters at a distance of 5 meters from the instrument. Such findings become more frequent, with V. = 1/10; only few can recognize a distance of less than 30 centimeters. With smaller visual acuity none can recognize 30 cm. difference.

To find out the stereoscopic vision of these latter persons they were examined at 4 meters and even at 3 or 2 meters. These observations are found in a third table. But among the persons thus examined were wide differences of stereoscopic vision. A person with V. = 5/10 did not even recognize, at 2 M. from the instrument, a distance between the threads of 30 centimeters. But persons with V. = 4/10 and 3/10 make good observations at 4 meters. With V. = 2/10, and 1/10 these determinations become much worse. Many could only make such determination at 3 meters, and and not a few at only 2 meters; while with one with V. = 1/10 this was not possible even at 2 meters. With smaller visual acuity the determinations at 4 M. became impossible, until a case with V. = 1/50 surprised with a good determination.

E. E. B.

PROTECTIVE GLASSES.

The choice of glasses to protect the eye from harmful radiations has until recently been empirical. Blue, green, smoke, amethyst, and amber glass have in succession been urged by some one, as best suited to protect the eye from excessive exposure. According to the reputation or plausibility of their advocates has one kind of glass or another found general favor with the profession, or the public. But something of a scientific basis for the choice of a particular kind of glass for a particular kind of service now becomes possible.

The report made to the Section on Ophthalmology at the New Orleans meeting (see p. 688) places at the command of the oculist the data needed for a scientific selection of the kind of glass that will give the protection required from a certain kind of exposure. The observations recorded in this report have been made by trained expert observers in a sufficiently equipped physical laboratory. So far as they go they can be relied on as accurate. Of course, they deal only with samples of protective glass that have been recently obtainable, and cannot be expected to exhaust the possibilities of such protection that may be developed in the near future.

For the samples actually examined the observations were probably accurate to within a minute fraction of one per cent. But the variations that occur in different samples of glass, sold under the same name, must be allowed for, even tho they be carefully made by the same formula; so that the figures given in the table can only be regarded as an approximation to what the patient will get on prescription. An exact prescription would also have to include the thickness of the glass to be furnished. But a fair approximation to the average thickness of spectacle glasses was had in the samples tested; and the thickness of these being given, allowance can be made for lenses of unusual thickness. With all its limitations the report furnishes data that make possible a more accurate and effective use of resources at our command for protection of the eyes.

Aside from protection from wind, dust and flying solid masses, glasses may be used to exclude three sets of radiations that might prove harmful to the eyes; infrared or heat radiations, the visible spectrum, when the light is too intense, and the ultraviolet or actinic radiations. For these three different purposes different kinds of glass must be chosen. Much of the older literature on the subject of protective glasses is of little value, because of failure to discriminate between these three kinds of injurious influences to be guarded against. Guarding against excessive heat is a different matter from guarding against an excess of ultraviolet radiation, and both differ from exclusion of excess of light.

The exclusion of ultrared radiations from the deeper parts of the eye is well provided for. Water is extremely opaque to heat rays, and cornea, aqueous, and vitreous share this protective function. But the glass found most efficient in this direction is ordinary crown glass covered with a very thin layer of gold. Such glass excludes 99 per cent of the heat rays, yet it still transmits about 23 per cent of the visible rays in the green part of the spectrum. Crookes' sage-green Ferrous glass (entirely different from the Crookes' A and B so widely advertised), cuts off almost as much of the infrared, but transmits 44 per cent of the visible green light; and the light bluish-green glass (Corning G. 124 J. A.), excludes heat almost as well, and transmits 52 per cent green light. It is possible with these glasses to afford protection practically complete from all harmful heat.

Ultraviolet radiations penetrate the ocular media much more deeply. For their exclusion we must depend more upon glasses of special chemic composition placed before the eyes. Of these some, like the "Crookes' A" glass are very nearly colorless, and transmit freely most of the visible spectrum, but greatly reduce the ultraviolet radiations. Other glasses having slightly more color, generally greenish, like

"noviol C," transmit a little more light and exclude a little more of the ultraviolet rays. With glasses of this class the ultraviolet of ordinary artificial illuminants, or sunlight even at high altitudes can be rendered harmless.

When, however, it is necessary to face a source of ultraviolet and visible rays of high intensity, with a proportion of heat rays as in electric or oxyacetylene welding a different problem is encountered. To meet this situation glasses that interrupt a large part of both the visible and the ultraviolet rays, and to some extent the infrared are needed. The supply of such glass is apparently not yet so well worked out and standardized as is the case for the other kinds of protection. But various "black," dark purple-red, and yellow glasses combine these qualities in high degrees. They are not likely to be prescribed by the oculist, but are known chiefly to those who may need to use them in work requiring exposure to intense light sources.

Much remains to be done in the direction of testing different kinds of glass that may be put forward, as to their transparency to various radiations. Much also remains to be done to set forth in clear readily understandable terms the results already arrived at. Such needed advances will be stimulated if ophthalmologists generally study the subject carefully, and begin to formulate their demands more definitely than they have done heretofore. To procure and carefully study the publications of the Bureau of Standards setting forth the results of such tests "Technologic papers No. 93 and No. 119" is a good start to make in that direction. E. J.

THE MOORFIELDS APPEAL

Below will be found a statement which must surely touch a responsive chord in the hearts of the majority of our readers. American ophthalmologists are few, who in their travels and studies abroad, have not visited or labored within the hospitable walls of "Moorfields," either of the old building near the Liverpool Station or on the City Road.

Ever since 1804, when it was founded by Saunders mainly for the relief of that terrible trachoma brought by returning troops from the Egyptian campaign, until the present day, Moorfields has freely furnished the English speaking profession thruout the world with unsurpassed facilities and opportunities for the study of our specialty in all its branches. The long list of attending surgeons of the Royal London Ophthalmic Hospital not only includes many of the most distinguished teachers of British ophthalmology, but its roster of clinical assistants and house surgeons bears the names of many a brilliant ophthalmologist from this side of the Atlantic.

Let us, then, show our appreciation of the good work done by this admirable institution by contributing generous checks, either direct to the Committee, or thru the Editor of this Journal, who will be glad to receive and forward them to the proper official.

C. A. W.

CORRESPONDENCE

THE ROYAL LONDON OPHTHALMIC HOSPITAL

This Hospital, established 116 years ago, and best known thruout the civilized world by its popular name "The Moorefields Eye Hospital," is the parent of all similar institutions thruout the English speaking world.

In 1811 Dr. Edward Delafield and Dr. J. Kearney Rodgers, then young men who had recently graduated in medicine at the College of Physicians and Surgeons in New York, came to London and studied at this Hospital under Dr. Farre and Mr. Benjamin Travers. On their return to their own country in 1818, so impressed had they been with all they had seen and learnt at the London Eye Infirmary, as it was then called, that they determined to establish a similar institution in America.

This they succeeded in doing and in

August, 1820, "The New York Eye and Ear Infirmary" commenced the great and beneficent work which it continues to carry on at the present time.

In 1816 Dr. Edward Reynolds came from Boston, Mass., to London to pursue his medical studies. He attended the practice and lectures at this Hospital under Mr. Benjamin Travers and Sir William Lawrence. On his return home he found his father blind from cataract in both eyes. With rare courage, fortified by his recent experience in London, he decided to operate. Happily the operation proved a complete success. It had never been undertaken in Boston before. It led to the foundation of Dr. Reynold's reputation as the leading surgeon in diseases of the eye, and to the foundation in 1824 of "The Massachusetts Charitable Eye and Ear Infirmary," which still exists as a center of light and leading.

Ever since these fathers of ophthalmology in the United States came to study at this Hospital there has been a continuous succession of American medical men working in its wards, its operation theater, its out-patient department, and its laboratories.

Nurses like medical men, who are engaged in the treatment of diseases of the eye require special training beyond that which is provided for them in their ordinary curriculum. Moorfields Hospital aims not only at supplying all that is required for training ophthalmologists but also in supplying suitable training for ophthalmic nurses. Many nurses who have received such training at this Hospital have gone from it to take up similar work in various parts of the British Empire and America.

Immense progress has been made in ophthalmology since the Hospital was first established, and much of this has been effected by the researches of the many distinguished surgeons who have served on its staff.

Many further advances are ripe for investigation in several different directions, but can only be carried out if the necessary means are forthcoming. Work such as this benefits not only one class, one community, or one nationality, but the whole human race.

Moorefields Hospital feels that, in view of what it has already accomplished and what it is striving to do in the future, it is justified in appealing for the necessary funds not only to the British but also to the American public.

It asks then for a contribution toward a fund of £100,000 for the following purposes:

(a). To enable it to extend its laboratory accommodation for purposes of clinical and pathologic research.

(b). To supply adequately paid assistance to the Honorary Medical Staff, which will liberate them from much of the routine work which they now have to perform, and allow of them devoting more of their time to clinical instruction and research for which they are so eminently qualified.

(c). To supply adequate accommodation for the nursing staff, not only those who carry on the general work of the Hospital, but also those desirous of obtaining a special training in the nursing of cases of diseases of the eye.

PRINCE ARTHUR OF CONNAUGHT,
President of the Hospital.

BOOK NOTICES.

Harald G. A. Gjessing. Kliniske Linsestudier. Paper, 8 vo., pp. 356, with tables and 12 charts. Drammen, Norway. 1920.

This book, published as a supplement to the Norsk Magazin for Laegevidenskaben, may be of little direct value to those of us who cannot read the Norwegian-Danish language. But in some measure it illustrates an investigation that can be carried on in any part of the world; and must be joined in by many workers before its object can be attained. Gjessing begins and ends by quoting from Le Grand Nichol (1574) "Non ergo credo omnium suffusionum est eadem causa," hinting the wide etiology of cataract. And with this he joins the recent statement of Roemer (1913), that "today is the true cause of the development of senile cataract unknown." To the solution of the unsolved problem he

had applied a large amount of observation, especially with the aid of the Gullstrand lamp and the corneal microscope.

After describing methods of examination, including use of red-free light, the normal lens after 15 years of age is discussed, and then the lens after birth until 15 years. Then the pathologic anatomy of the lens, and the more important theories of cataract are given, toxic, chorioretinal, action of light, heredity, the internal secretions, tetany, and finally the Hess-Roemer theory of cataract. After this in tabular form are arranged what are supposed to be the important collateral facts bearing on the condition of 4,768 eyes of 2,411 persons.

The cases are arranged in five year groups beginning with 6 to 10 years; of blue eyed males, blue eyed females, brown eyed males and brown eyed females. The facts noted are arranged in 9 columns giving: (1) Age and name. (2) Race relations or family history. (3) General conditions supposed to have influence. (4) Special observations on other parts of the eye. (5) Vision and refraction. (6) Condition of the lens nucleus. (7) Description of variety of cataract. (8) Localization of the opacity. (9) Remarks.

This tabulation of observations occupies 180 pages. It is followed by a consideration of the various agencies related to the condition in the different periods; and special analysis as to certain things like the refraction, the localization of the opacities, family history, etc. The volume concludes with an appendix on tonometry, a resume, and list of available literature including 405 titles to papers supposed to bear on the subject, of which 18 appeared in Great Britain and 4 in America. Evidently only the Scandinavian and German literature are familiar to the author. E. J.

Fifth Annual Report, 1917, Ophthalmic Section, Department of Public Health. Egypt. Quarto. pp. 24. 3 charts and 20 tables. Cairo, Government Press, 1919.

This pamphlet, prepared by the Director of Ophthalmic Hospitals in Egypt, Dr. A. F. MacCallan, reports the work done at 13 permanent and 4 traveling hospitals during the year 1917. There were 81,529 new patients treated, and for these 59,581 operations were done. The attendances of outpatients numbered 1,004,161.

Altho these pages are about twice the size of those of an ordinary medical book, we know of no work of the kind in which such valuable information is so closely packed. The large page offers a favorable means for presenting tables and charts, which give statistical facts in most condensed form. Each of these tables is valuable. For instance, the first, which is one of the smaller ones, gives the patients coming on account of acute conjunctivitis, a total of 12,642 arranged according to diagnosis under 10 heads.

Another of the smaller tables (table XI) deals with the incidence of primary glaucoma. Of these there were 9,686 cases for whom were done 2,924 operations. For trichiasis and entropion, the operations done numbered 30,200, not including epilations and electrolysis for destruction of lashes.

The report ends with an appendix giving the annual publications of the "Ophthalmic Section," and telling if they are available.

We shall have occasion to use from time to time some of the material here assembled. The report as a whole challenges attention to the possibilities of Egypt as a training ground for certain kinds of operations. It is interesting to note among the activities of the Ophthalmic Section, the giving of a complete course of postgraduate lectures on ophthalmology, including pathologic and bacteriologic demonstrations and laboratory work.

E. J.

Tractus de Conservatione Sanitatias Oculorum. Johannis de Lasso. Octavo, 10 pages. Figueras, Spain. F. Cusi.

This treatise on the hygiene of the eye was written by Doctor de Lasso of Florence in July, 1346. From copies of the Latin manuscript, found in the

National Libraries of Paris and Metz, Dr. P. Pansier, of Avignon, published it in 1903. This present publication is of a French translation by Prof. Jean Lamouroux. It is neatly printed in antique lettering with illuminated title page and heading. It is one of those literary bridges, which carry the student into the thinking and atmosphere of the middle ages.

After an exordium which magnifies the importance of vision, chapter I takes up Things Which Injure the Eye and Weaken It. Chapter II is Of the Things Beneficial and Strengthening to the Sight. Chapter III deals with the Question of Remedies Suited to Preserve the Sight and to Restore That Which Has Been Lost. Chapter IV treats of Medicines and Electuaries to Preserve and Restore the Sight. Chapter V is devoted to Diet.

We do not find here any mention of spectacles or cataract operations, mydriatics, myotics, or the cautery. The thought that arises from a glance thru these pages is one of appreciation of the enormous advance that ophthalmic science and art have made in the last six hundred years.

The work of Pansier we could ill afford to lose from among our histories of ophthalmology. And it is a piece of commendable, as well as shrewd advertising for the Cusi Laboratories of the North of Spain, to give a wider circulation to this little brochure. The rescue and preservation of a classic is a worthy claim to attention and remembrance. In this case the tract used is not submerged in the advertising it carries. E. J.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply the news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. H. Alexander Brown, San Francisco; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. Geo. H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Guatemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago; Dr. John E. Virden, New York City; Dr. John O. McReynolds, Dallas, Texas; Dr. Edward F. Parker, Charleston, S. C.; Dr. Joseph C. McCool, Portland, Oregon; Dr. Richard C. Smith, Superior, Wis.; Dr. J. W. Kimberlin, Kansas City, Mo. Volunteers are nedeed in other localities.

DEATHS.

Dr. Luther Z. Breaks, Terre Haute, Ind., aged forty-one, died of angina pectoris, July 10.

Dr. John F. Campbell, Chicago, aged fifty-six, died July 14 from angina pectoris.

Dr. Hiram B. Morse, Bay City, Mich., aged forty-nine, died July 13 from cerebral hemorrhage.

Dr. Ernest A. Robin, New Orleans, La., aged fifty-one; Professor of Diseases of the Eye in the New Orleans Polyclinic; First Assistant Surgeon in the Eye Department of the Eye, Ear, Nose and Throat Hospital, New Orleans; died, July 9 from heart disease.

Dr. John Steinbach, Winona, Minn., aged sixty-four, died April 28.

PERSONALS.

Col. F. P. Maynard, formerly of Calcutta, India, has returned to England, and will continue a consulting practice in Crewe, England.

Dr. Henry S. Miles, of Bridgeport, Conn., announces the removal of his offices to the Professional Building, 881 Lafayette street.

The partnership practice which has been carried on by Dr. Nelson M. Black and Dr. Vernon A. Chapman at Milwaukee terminated, May 12, 1920, one year from the former's return from service—in accordance with the original agreement. Each will individually continue the practice of ophthalmology and otolaryngology in the Wells Building, 120 Wisconsin street, Milwaukee.

Dr. James A. Spalding, of Portland, Me., celebrated, on June 28, 1920, his medical golden wedding, his medical degree having been received at Harvard University in 1870. The Doctor has been a life-long sufferer from deafness, so that his great success as a specialist on the eye, ear, nose and throat seems remarkable. Not long ago he operated on a patient ninety-two years of age for cataract, with a perfect result, the average age of patient and operator being eighty-one years plus. He also had the pleasure, perhaps unique, of

operating, very long ago, for cataract on a woman aged ninety, with excellent vision, and, in recent years, on her son, aged eighty-six, again with a perfect result. The Doctor has written and translated numerous scientific papers and books, and is now president of the Maine Medical Society and editor of the Maine Medical Journal.

SOCIETIES.

The Colorado Congress of Ophthalmology and Oto-Laryngology met in Denver July 23 and 24. The program was of unusual excellence and the attendance large. Thirteen different states were represented. The mountain parks ride and dinner on the evening following the meeting was enjoyed by all. The ophthalmologic papers presented will be published in the American Journal of Ophthalmology.

The meeting of the American Academy of Ophthalmology and Oto-Laryngology will be held at the Muehlbach Hotel, Kansas City, Mo., October 14-15-16. This will be the twenty-fifth annual meeting of the Society and will be made something of an anniversary of the occasion. The local committee of arrangements, of which Dr. Hal Foster is chairman, is planning to make the occasion a very pleasant one. The program is about completed. Members desiring to illustrate their papers or discussions by lantern slides stereopscopic, microscopic, etc., should communicate with Dr. Joseph Lichtenberg, Rialto Building, Kansas City, Mo.

The Pacific Coast Oto-Ophthaimological Society met in Portland, Ore., on July 22-24. Some important ophthalmologic papers were presented which we hope to publish in subsequent issues of this journal. One who has attended similar meetings in different parts of this country describes this as "one of the most satisfactory meetings that I have ever attended."

MISCELLANEOUS.

Examinations for the certificate of the American Board of Ophthalmic Examinations will be held at Kansas City, Mo., October 13, the day preceding the meeting of the American Academy of Ophthalmology and Oto-Laryngology, at the Medical Department of the University of Kansas, Rosedale, Kan., which may be reached by trolley line from the center of Kansas City every few minutes.

A diploma in ophthalmic medicine and surgery will hereafter be given by the Conjoint Board of the Royal College of Surgeons of England and the Royal College of Physicians of London. The examinations of this conjoint board in medicine, surgery and obstertrics have been recognized thruout the world as a test of fitness for high positions in the medical profession. The new examination will be divided into two parts. Part one includes the anatomy and embryology of the visual apparatus, the physiology of vision and elementary optics. It may be taken by any one who has qualified in medicine, surgery and midwifery. Part two consists in the examination upon optical defects of the eye, ophthalmic medicine and surgery and pathology. It may be taken on the completion of one year of special study of ophthalmology.

The Nela Research Labratory was organized in 1908 under the directorship of Dr. Edward P. Hyde as The Physical Laboratory of the National Electric Lamp Association. The name was changed to Nela Research Laboratory in 1913, when the National Electric Lamp Association became the National Lamp Works of General Electric Company. For some years the Laboratory was devoted exclusively to the development of those sciences on which the art of lighting has its foundation, but in 1914 the functions of the Laboratory were extended by the addition of a small Section of Applied Science, which had an immediate practical objective.

Section of Applied Science is now being largely extended as a separate Laboratory of Applied Science under the immediate direction of Mr. M. Luckiesh, who becames Director of applied Science, and a new building is being constructed to house this branch of the work, which will be carried forward with a staff of several physicists, an engineer, an architect and a designer, together with the necessary technical and clerical assistants.

Dr. Ernest Fox Nichols, formerly President of Dartmouth College, and more recently professor of Physics at Yale University, has accepted an invitation to assume the immediate direction of the Laboratory of Pure Science, under the title of Director of Pure Science. The work of this Laboratory, which will be continued in the present building, will be somewhat further extended under the new organization.

The Laboratory of Pure Science and the Laboratory of Applied Science will together constitute the Nela Research Laboratories, and will be coordinated under the general direction of Dr. Hyde, who becomes Director of Research.

OPHTHALMIC LITERATURE

These lists contain the titles of all papers bearing on Ophthalmology received within the preceeding month. These titles are all in English, some of them modified to indicate more clearly their subjects. These subjects are grouped under appropriate heads the succession of groups being the same from month to month. In the group the papers are arranged alphabetically usually by the name of the author in heavy-face type. After the subject of the paper (Ill.) indicates the number of illustrations. (Pl.) the number of plates, and (Col. pl.) colored plates illustrating the article. (Abst.) shows that it is an abstract of the original article. (Bibl.) tells that the paper is accompanied by an important bibliography. (Dis.) means that discussion of the subject is published with it. Under Repeated Titles are indicated additional publication of papers already noticed. To secure the earliest possible notice writers may send copies of their papers, or reprints, to 318 Majestic Bldg., Denver, Colo.

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Howard, H. J. Uniform System of Eye Tests. China Med. Jour., 1920, v. 34, p. 226. Abst. Amer. Jour. Ophth. v. 3, p. 702.

Peter, L. C. Essentials of Perimetry. (Dis.) Amer. Jour. Ophth. v. 3, p. 524-526, 584-587.

Repeated Titles. **Gallemaerts and Kleefeld** (v. 3, p. 237) Amer. Jour. Ophth. v. 3, p. 542.

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Vandegrift, G. W. Optics of Cornea. Arch. of Ophth. v. 49, p. 421-429; and 450.

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